

MBTA I-90/I93 Coordination Contract, Phase V
Coordination, Planning and Conceptual Design Services
Contract # S0PS17

Fenway Park Game Day Service Improvement Study

Introduction

In the spring and summer of 2000, under subcontract to Stone and Webster Civil and Transportation Services, Inc., KKO and Associates, LLC conducted four analyses for the Massachusetts Bay Transportation Authority concerning potential improvements in transit service to improve accessibility for baseball fans to Fenway Park in Boston. The analyses are documented in four technical memoranda. These technical memoranda are presented here as an addendum to Spring 2000 study report concerning the *Feasibility of Full-Time Commuter Rail Service to the Fenway/Kenmore Area*

The four technical memoranda cover various planning topics related to game day service to the proposed new and larger baseball stadium for the Fenway/Kenmore area.

1. **Review of Current Plans** - This technical memorandum documents the findings of the review of current plans for improvements in game day transit service prepared by the Red Sox and the City of Boston. The plans outline a program of capacity enhancing improvements to existing services that could be effective in handling larger crowds to the ballpark.
2. **Literature Review** - This technical memorandum summarizes several reports and scholarly articles on fan transportation to and from baseball stadiums. The literature indicates that there is a complex relationship between transportation supply (highway capacity, parking availability, and transit service) and travel behavior at stadiums
3. **Review of Current Services** - This technical memorandum reviews current game day services provided by the MBTA. This memorandum also reports on observed demand for existing MBTA game day services, compares Red Sox game day services provided by the MBTA with MBTA services to other special events, and describes the new Fenway - Ruggles shuttle which is provided by the Red Sox using a private bus carrier.
4. **Identification and Evaluation of Strategies to Improve Game Day Service** - This technical memorandum identifies and evaluates a variety of strategies that could be pursued by the MBTA to improve game day service performance. Evaluated MBTA game day strategies fall into three categories: institutional changes, operational changes, and capital investments.

Technical Memorandum

DATE: June 12, 2000

PROJECT: MBTA I-90/I93 Coordination Contract, Phase V
Coordination, Planning and Conceptual Design Services
Contract # S0PS17
Fenway Park Game Day Service Improvement Study

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SUBJECT: **Technical Memo #1: Review of Current Plans**

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Introduction and Summary

Under subcontract to Stone and Webster Engineers, KKO and Associates, LLC is conducting four analyses for the Massachusetts Bay Transportation Authority concerning potential improvements in transit service to improve accessibility for baseball fans to Fenway Park in Boston. The analyses are to be documented in four technical memoranda.

This technical memorandum documents the findings of the review of current plans for improvements in game day transit service prepared by the Red Sox and the City of Boston. The plans outline a program of capacity enhancing improvements to existing services that could be effective in handling larger crowds to the ballpark. The Red Sox plan sets an implicit goal for MBTA ridership to a new larger ballpark at the current transit mode share (23%). The, as yet unpublished, City plan will likely call for a higher transit mode share for an enlarged ballpark. The plans do not provide any quantitative estimates of the potential effectiveness of the proposed improvements. Nor do they discuss the operating cost implications of the improved services.

Purpose and Scope

KKO assembled and systematically reviewed plans prepared by the Boston Red Sox and others for improvements in transit service to Fenway Park. The findings of that review are documented in this technical memorandum summarizing the plans' recommendations and commenting on the potential effectiveness and efficiency of the recommendations. The memorandum has three substantive elements:

1. Summary of recommendations contained in the plans,
2. Comments on the potential effectiveness of the plans' recommendations, and
3. Comments regarding the efficiency of the recommendations.

Background

Two constituencies have prepared, or are preparing, plans for handling the flow of people to and from Red Sox games at Fenway Park:

1. The Boston Red Sox have published a document entitled *Fenway Area Proposed Transportation Improvements* prepared by the consultant team of Howard/Stein-Hudson Associates, Inc. and Vanasse and Associates, Inc.

The Red Sox plan was published in August 1998 and updated in August 1999. According to the Red Sox' consultant team, a further revision to non-transit portions of the plan was made in November 1999. No copy of the November 1999 update was received by KKO.

2. The City of Boston (in conjunction with Fenway neighborhood groups) is in the process of preparing a plan using the consulting firm of Volmer Associates. According to the City's consultant, the City plan is expected to be available in early summer, 2000.

Both planning efforts address the proposed replacement/expansion of Fenway Park by 11,259 seats to 44,130 seats (a 33% expansion). Both transit portions have some applicability to the current 33,871-seat facility.

KKO reviewed the August 1999 update of the Red Sox Plan in detail and interviewed both consultant teams in early June 2000.

Summary of Plan Recommendations

Red Sox Plan -- The Red Sox have conducted surveys and studies to understand the travel patterns of attendees at baseball games at the current Fenway Park. Based on 1996 surveys, they estimate the transportation modal split of patrons and the relative use of the various highway corridors by those who travel by automobile to and from the games.

Table 1.1 Estimated 1996 Modal Split among Fans at Regular Season Home Games	
Mode	Share
Automobile ¹	68%
MBTA subway or bus	20%
MBTA commuter rail	3%
Charter bus	3%
Walk	5%
Other modes	1%

¹ The Red Sox estimate that automobile trips average 3.1 persons per car.

Table 1.2 1996 Estimated Automobile Trip Distribution by Highway Corridor	
Corridor	Share
I-90 west (Mass Pike)	27%
Route 3 south	18%
I-93 north	15%
I-95 South	12%
I-95 north / US route 1 north	10%
Routes 2 & 2A north	9%
Local streets	5%
Route 3 north	3%
Route 9 west	1%

The 1996 survey data published by the Red Sox does not address potential differences in mode split or automobile trip-end distribution among the 28 weekend/holiday games, 51 weeknight games, or 3 weekday games that were played.

The Red Sox plan assumes that the 1996 modal and corridor splits will remain constant at the larger stadium. The plan supposes that the number of patrons expected to use each particular mode or each particular highway corridor would grow in proportion to the increase in seats at the ballpark.

Table 1.3 Changes in Game-related Travel by Mode due to Increase in Seats (Projected by Red Sox)		
Mode	Existing	Projected
Automobile	23,033 people (7,430 autos)	30,008 people (9,680 autos)
MBTA subway or bus	6,774	8,926
MBTA commuter rail	1,016	1,324
Charter bus	1,016	1,324
Walk	1,694	2,207
Other modes	338	441
Total	33,871	44,130

MBTA subway/bus ridership would increase by 2,052 fans.
Commuter rail ridership would increase by 308 fans.
(Based on sold-out games)

The Red Sox plan does not contain measures designed to improve transit mode split. Rather, the plan recommends five measures that the baseball team believes will provide MBTA capacity to handle an increase in game-related patronage proportionate to the increase in ballpark capacity:

1. Improvements to “streetscape” in Kenmore Square and within Kenmore Station to facilitate pedestrian flow into the station at the end of ballgames.
2. Additional cars on existing Green Line trains on weeknight games to accommodate additional transit riders.
3. Improved pedestrian access and other improvements to Fenway Station (Riverside Line).
4. Rebuilding of Yawkey Station (commuter rail) and operational changes to allow more frequent use both for games and for regular commuting.
 - lengthened platforms
 - platforms serving both main line tracks
 - changed schedules of Framingham/Worcester line trains
 - shuttle service to South Station and Back Bay
5. Intermodal connections at Yawkey Station to enable connections with MASCO shuttle buses to the Longwood medical area.

The Red Sox plan indicates the following transit-related capital costs:

- \$3.3 million for Yawkey Station improvements
- \$1.9 million for Fenway Station improvements
- \$8 million for Kenmore Station improvements
- \$7 million for Kenmore Square streetscape

The plan indicates that MBTA would pay \$500,000 of the Fenway Park station improvements and all of the \$8 million Kenmore Station improvements.

Telephone conversations with the Red Sox and team’s consultants during June 2000 indicated recent problems had been experienced when night games ran late and the scheduled commuter train from Yawkey Station to Framingham/Worcester departed before the game’s end. This stranded ballgame patrons in Boston. The Red Sox indicated a desire for improved coordination between the Red Sox and commuter rail operations. The consultants suggested that a dedicated train that would run to Framingham at the time of the actual end of game would be desirable.

In the same telephone conversations, the Red Sox’ consultants indicated the desire for better communication between the ballpark and the Green Line dispatcher to coordinate service between Kenmore and downtown at game’s end.

City of Boston Plan -- Since the City's plan has yet to be published, the following is based on informal discussions with the City's consultant. Contents of the City's plan are still being formulated. A plan may be presented as early as a community meeting scheduled for the evening of June 12, 2000.

The principal emphasis of neighborhood groups' concerns appears to be on parking and the increased automobile traffic that might result from a higher-capacity Fenway Park. As of early June 2000 less emphasis had been made on transit improvements than on automobile traffic issues. However, attention to transit issues focuses on the following:

- The establishment of Yawkey Station as a daily station stop for Framingham/Worcester commuter rail trains,
- Increased public transportation availability at Red Sox games, and
- A public transportation (rather than parking) solution to the daily transportation demands that may be generated by a proposed five to six acre office space development that will be an adjunct to the proposed new baseball facility.

As of June 8, 2000, greater specificity was not available regarding the City's transportation issues.

Potential Effectiveness of Plans' Recommendations

All of the proposals and recommendations in the reviewed plans are technically achievable. No estimates of the market potential for any recommended transit improvement are provided in the plans. Some questions regarding effectiveness of the recommendations and sources of the operational and economic means to implement the recommendations are noted below.

1. The Red Sox plan's recommendations are based on the assumption that mode split among stadium fans will not change. As such, 6,975 additional patrons will use 2,250 additional automobiles per game. This may be unacceptable to City and neighborhood constituencies. The MBTA should expect to see some pressure to achieve an increased transit mode share to relieve the automobile impact of the proposed new larger ballpark.

As an extreme example, if the MBTA were to attract and handle all the increased fan traffic at a sold out ball game, it would need to increase its average ridership to ball games by 9,335 fans. This is a huge increase over the current 7,890 MBTA riding fans per sold out game estimated by the Red Sox.

2. The Red Sox plan's recommendations for Kenmore Square streetscape and Kenmore Station apparently assume that the sidewalks, the station stairs, and the station access tunnels are the limiting factors in quickly accommodating passengers when a game lets out. If, however,

fare collection, platform congestion, and/or dwell times for crowded trains are the limiting factors, then improved sidewalks, stairs, and tunnels are not an effective remedy to station capacity between Fenway Park and trains at Kenmore Station.

3. The Red Sox plan discusses \$8 million for projected improvements to Kenmore Station. These funds appear to be for already-planned ADA access improvements at Kenmore Station. While important in its own right, improved ADA access may do little to improve the station's ability to handle crush loads when games let out.
4. Without additions to the Green Line fleet, the Red Sox recommendation concerning extra cars in the early evening may be impossible to achieve. Green Line fleet utilization already approaches its daily maximum during evening rush hour prior to game time. Those cars that are about to go out-of-service at the end of the peak are at outlying terminals. Additional early evening capacity however tends to be required at North Station, Haymarket, Government Center and Park Street to accommodate the demand of increased passengers transferring from the three rapid transit lines and commuter rail.
5. After games, more of the Green Line fleet could perhaps be available for ball game fans. But in practice we expect to find in Task 3 of this project that there are under appreciated difficulties in staging and funding increased service to offer more seats more rapidly to fans boarding the Green Line at Kenmore and Fenway Stations.
6. The Red Sox proposed improvements to Fenway Park station on the Riverside line might have a limited effect. Increased use of Fenway Station by Riverside riders might result, but most of the burden removed from Kenmore Station after games would be at the westbound platform which is less heavily used at game's end. Increased use of Fenway Station for eastbound passengers would not relieve delays due to subsequent crush loading of the same trains at Kenmore. Eastbound riders boarding at Fenway Station would not be able take advantage of any special (run as directed) trains stored just west of the tunnel portal on the Commonwealth Avenue Line.
7. The August 1999 update of the Red Sox plan proposes a parking garage that would eliminate any use of the stub end of the former Highland branch (between Yawkey and Fenway stations) for commuter rail loading and storage. Without this track, some options for increased commuter rail service to the ballpark could become more difficult to achieve. (It is understood from press accounts in May 2000 that this potential conflict has been recognized and accommodated by the Red Sox revised parking proposals.)
8. KKO's previous work indicates that providing station platforms serving both main line tracks at Yawkey Way station would be impossible to achieve without realigning tracks, shifting bridge supports for nearby overpasses and/or encroaching on the Massachusetts Turnpike.

9. The Red Sox plan is vague on the improved game day services that could be offered to an expanded Yawkey Station. No specific proposals for new trains or game day services are provided. Consequently no estimates of potential ridership or operating costs are presented in the plan. With few specifics it is difficult to comment on the potential effectiveness of the proposal. (KKO will be developing some concepts for expanded commuter rail game day service in Task 4 of this project.)
10. Proposed shuttle service between South Station and Yawkey faces severe capacity constraints at South Station.
11. Regarding the coordination of Green Line service at the end of Red Sox games, it has been KKO's understanding that Green Line dispatchers already monitor (by radio and television) the progress of special events including the Red Sox games and dispatch accordingly. The Red Sox and their consultants report that the stadium and the MBTA have recently begun more direct communication via phone regarding crowd conditions leaving Fenway Park.
12. Neither plan addresses the potential of priority bus routing to improve bus access to ballgames by restricting automobiles from critical lanes or streets.

Potential Efficiency of the Recommendations

The plans reviewed were silent on the questions of operating costs, rolling stock and crews to offer the increased service. Without estimates of operating costs or estimates of market potential it is generally difficult to estimate the potential efficiency of the proposed service changes. Specific comments regarding efficiency are provided below.

1. Service quality on the Green Line could be improved if the surge of patrons at the end of each game could be attenuated. A potentially efficient but unexplored transportation strategy would seek to spread the crush of transit riders immediately after each game. Post-game activities in the ballpark and street entertainment outside the ballpark could alleviate the torrent of fans racing to transit stations and parking lots after the game.
2. Neither plan addresses the operational costs to the MBTA of stopping more commuter rail trains at Yawkey. These operational costs include increased equipment maintenance, increase train crewing, fuel and infrastructure maintenance.
3. The Red Sox plan does not address the operational costs to borne by the MBTA that would result from adding cars (and personnel²) to existing Green Line trains.
4. Neither plan addresses the availability of commuter rail equipment or crew that would be required to run the dedicated Red Sox train to Framingham after night games.

² One additional operator for each additional car.

5. The Red Sox plan provides insufficient detail on proposed new commuter rail services to allow for an evaluation of potential efficiency.
6. The Red Sox plan implies use of the proposed Urban Ring MBTA service. The time line for this ambitious service improvement contemplates a full build in 20 to 25 years.
7. Neither plan addresses if, how, and at what cost positive changes in transit mode split among Red Sox stadium fans could be achieved.

Technical Memorandum

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Fenway Park Game Day Service Improvement Study

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Introduction

Under subcontract to Stone and Webster Engineers, KKO and Associates, LLC is conducting four analyses for the Massachusetts Bay Transportation Authority concerning potential improvements in transit service to improve accessibility for baseball fans to Fenway Park in Boston. The analyses are to be documented in four technical memoranda.

This technical memorandum documents the findings of the literature review task.

Method and Summary

A total of six reports and scholarly articles on fan transportation to and from baseball stadiums were identified from three sources:

1. Transportation Research Board publications 1996-1999
2. Massachusetts State Transportation Library
3. KKO and Associates, LLC Library

The literature indicates that there is a complex relationship between transportation supply (highway capacity, parking availability, and transit service) and travel behavior at stadiums. For instance, the literature reports that:

- vehicle occupancy rates in private cars are adversely impacted by good transit service,
- superior transit service contributes to demand peaking for transit services,
- limited parking availability increases occupancy rates in private automobiles and also increases transit use, and
- good accessibility appears to increase attendance at games involving mediocre teams.

The most salient specific findings of the literature review are listed below.

- Baseball is seldom played before a capacity crowd. The win-loss percentage of the team has a considerable statistical bearing on attendance. Planners suggest that the tenth highest game be used as the attendance benchmark for the “design crowd.” During the early 1970’s this was generally 80 to 85 percent of the stadium seating capacity.
- Traffic and parking availability seems to play a role in attendance for a mediocre baseball team. With better accessibility, a weak team will draw more fans. If a team has a good year, attendance will be high regardless of the transportation facilities available.
- Good transit service tends to sharpen the transit arrival peaks close to game time. With reliable service, the demand for travel on the transit lines is more peaked.
- Good transit access tends to depress average vehicle occupancy in private automobiles. Superior transit access appears to primarily attract the fans that would otherwise carpool to games. In one study, the average vehicle occupancy rate of 2.6 fans per automobile at the average stadium was reduced to 2.2 fans per automobile at stadiums with superior transit service. This finding suggests that a very cost effective strategy to reduce the transportation impacts of a larger Fenway Park might be for the team to offer preferential VIP parking for automobiles arriving with four or more ticketed fans.
- The planning literature generally suggests that a 2.5 persons per car average be used as a rule of thumb for baseball fan parking. The data reported in the tables suggests 3.0 passengers per automobile might be a more appropriate figure for urban stadium planning.
- Reported transit mode shares including charter services for seventeen baseball stadiums ranged from 4 % in San Diego in 1972 to 65% at Yankee Stadium in New York during the 1990 season. The Red Sox are consistently near the top of league in reported transit mode share with 31% to 38% of fans reported using transit to reach games.
- The reported ratio of seats to parking spaces at baseball stadiums ranged from 1.8 in Anaheim to 12.5 in Pittsburgh. Authors reported that stadiums with low parking availability tend to have very high reliance on transit for fan access.
- Traffic management volumes after baseball games is usually a bigger challenge than managing arriving crowds since the departure crowd is more peaked in its temporal distribution.

Table 2.1 shows 26 reported summaries of fan transportation data for 17 stadiums reported between 1972 and 1999.

Table 2.1
Reported Baseball Stadium Transportation Characteristics
Sorted by Reported Transit Mode Share¹

City	Stadium	Transit Share	Auto Share	Seats Per Parking Space	Average Vehicle Occupancy (Private Cars)	Year Reported
New York	Yankee Stadium	60%	40%		3.0	1990
New York	Shea Stadium	55%	45%	6.9		1972
Toronto	Skydome	50%	50%			1997
Boston	Fenway Park	38%	63%		3.3	1995
New York	Shea Stadium	37%	63%		2.3	1997
New York	Shea Stadium	35%	65%		3.2	1990
Boston	Fenway Park	32%	68%		3.3	1983
Boston	Fenway Park	32%	68%		3.1	1996
Boston	Fenway Park	31%	69%		3.2	1994
Pittsburgh	Three Rivers	30%	70%		3.5	1973
Seattle	Kingdome	30%	70%		3.0	1982
Cincinnati	Riverfront	24%	76%	11.1		1972
Pittsburgh	Three Rivers	23%	77%	12.5		1972
Montreal	Jarry Park	19%	81%	12.4		1972
Baltimore	Camden Yards	15%	85%			1997
Atlanta	Fulton County	13%	87%		3.0	1973
Houston	Astrodome	12%	88%	1.8		1972
Anaheim	Anaheim	9%	91%	3.5		1972
Milwaukee	County	8%	92%	4.3		1972
Cleveland	Jacobs Field	7%	93%		2.6	1997
Oakland	Coliseum	7%	93%	5.0		1972
Philadelphia	Veteran's	6%	94%		2.8	1973
Philadelphia	Veteran's	6%	94%			1999
Anaheim	Anaheim	5%	95%		2.6	1997
Los Angeles	Dodger	5%	95%	3.7		1972
San Diego	San Diego	4%	96%	2.7		1972
	Averages	23%	77%	6.4	3.0	

¹ Transit mode share is loosely defined as percent of patrons reporting that they arrived in a private automobile.

The data shown in Table 2.1 indicate that Boston is already near the top of both leagues in transit use to baseball games. Over the last 17 years, Fenway Park fans have consistently used transit for 31% to 38% of fan trips. Only fans of the Yankees and Mets in New York, and the Blue Jays in Toronto use transit at a rate competitive with Red Sox fans.

The finding that Boston is already near the top of the league in transit usage suggests that small improvements in transit service to Fenway Park may not be terribly effective in changing the transit mode share among fans. Changes in the quality and quantity of service available for private automobiles may be required to shift a substantial number of fans travelling by private automobiles onto the T.

Detailed Findings

The balance of this memo provides a concise synopsis of each the six reports reviewed by the project team.

Sproule, William J. "Some Transportation Aspects of a Sports Stadium" University of Toronto/York University: Joint Program in Transportation Research. Report Number 14. December 1973 (Source: Massachusetts State Transportation Library)

This 83-page report covers a wide range of topics relating to stadium transportation for baseball and football fans. The report summarizes the literature on system design (where appropriate) and reports on a survey of stadiums. It considers mode split, parking and highway access to stadiums. The most interesting findings and observations relative to planning for a new expanded Fenway Park are summarized below.

1. Only a small fraction of baseball games are scheduled to conflict with peak work travel. Highway and parking facilities designed for work travel are usually available for stadium fans. In 1973, only about 10% of baseball games were day games during the workweek. This number has probably shrunk in the last 25 years.
2. Baseball is seldom played before a capacity crowd. The win-loss percentage of the team has a considerable statistical bearing on attendance. (The recent local experience by the Boston Celtics basketball franchise exemplifies this phenomenon locally.)
3. Traffic and parking availability seems to play a role in attendance for a mediocre baseball team. With better accessibility, a weak team will draw more fans. If a team has a good year, attendance will be high regardless of the transportation facilities available.
4. Since baseball games are seldom played before a capacity crowd, planners suggest that the tenth highest game be used as the attendance benchmark for the "design crowd." During the early 1970's this was generally 80 to 85 percent of the stadium seating capacity.

5. Total transit mode shares including charter services for ten surveyed baseball stadiums ranged from 4% to 55%.

Table 2.2

City	Stadium	% Using Regular Transit Service (1973)	% Using Charter Express Buses (1973)	Average Attendance (1972)
Anaheim	Anaheim	3%	6%	9,420
Cincinnati	Riverfront	0%	24%	22,697
Houston	Astrodome	0%	12%	19,332
Los Angeles	Dodger	5%		25,491
Milwaukee	County	8%		8,830
Montreal	Jarry	4%	15%	15,863
New York	Shea	40%	15%	29,641
Oakland	Coliseum	5%	2%	13,162
Pittsburgh	Three Rivers	17%	6%	19,826
San Diego	San Diego	3%	1%	9,204
Boston	Fenway	N/A	N/A	19,223

6. Maximum walking distances from parking to the stadium were estimated by most studies as a function of the design crowd size.

Table 2.3

Design Crowd	Maximum Walking Distance
25,000	1,500 feet
50,000	3,000 feet

7. The seat to space ratio for selected baseball stadiums were reported as follows.

Table 2.4

City	Baseball Seats Per Parking Space
Anaheim	3.5
Cincinnati	11.1
Houston	1.8
Los Angeles	3.7
Milwaukee	4.3
Montreal	12.4
New York (Shea)	6.9
Oakland	5.0
Pittsburgh	12.5
San Diego	2.7

8. Traffic management volumes after baseball games is usually a bigger challenge than managing arriving crowds since the departure crowd is more peaked in its temporal distribution.

Grava, Sigurd and Nagle, Fred, "Get me to the Game on Time - Access Time Patterns at Baseball Stadia" Presented at 79th Annual Meeting of Transportation Research Board, Washington DC January 2000 (Source: TRB).

This 20 page paper observes arrival patterns at three baseball stadiums under varying conditions. The study's observations concerning rail transit access are very interesting. In particular the authors find:

1. Diehard fans tend to have a better idea of how the access network performs and tend to be better at planning their arrivals. (Arrivals at the game tend to be more peaked for low attendance games.)
2. Good transit service tends to sharpen the transit arrival peaks close to game time. (With good transit service, a larger fraction of the transit riders plan their transit trip to arrive just in time for the first pitch and leave less time to allow for transit service irregularities.)
3. Good transit access tends to depress average vehicle occupancy in private automobiles to 2.2 persons per automobile as opposed to 2.6 with fair to poor transit service. (With good transit service, the rate of carpooling to games goes down. That is, there is not a 2.6-to-1 relationship between new transit riders and cars off local streets.)

4. Stadiums with superior rail transit access in the US can typically achieve 40% transit mode split.

Data presented in the paper include the following information regarding transit mode split in 1997.

Table 2.5

Stadium	City	Typical Transit Mode Share	Maximum Observed Transit Mode Share
Camden Yards	Baltimore	15%	35%
Jacobs Field	Cleveland	7%	-
Skydome	Toronto	50%	-
Shea	New York	37%	41%
Anaheim	Anaheim	<5%	-

Geomet Incorporated, Vehicle Behavior in and around Complex Sources and related Complex Source Characteristics: Sports Stadiums Prepared for US Environmental Protection Agency, September 1973 (Source: Massachusetts State Transportation Library)

This 52-page report presents a general methodology for interpreting and understanding travel behaviors associated with sport complexes. The study is predominately oriented toward managing the air quality issues related to stadium traffic.

The study focuses on outdoor stadiums and presents information on travel to and from a number of large US sports stadiums based on a 1973 survey of stadium managers.

Table 2.6

Baseball Stadiums	City	% Fans Arriving by Auto	Avg. Vehicle Occupancy
Fulton County	Atlanta	87%	3.0
Veteran's	Philadelphia	94%	2.8
3 Rivers	Pittsburgh	70%	3.5

The majority of the paper focuses on highway traffic management before and after games.

Massachusetts Highway Department, Megaplex Conceptual Transportation Access Study,
Boston, Massachusetts, July 1993 (Source: KKO Library)

This one volume report was prepared to evaluate transportation access issues facing a proposed convention hall/stadium at two potential sites in downtown Boston. The study primarily focuses on handling crowds that would be attending football games at the proposed 70,000 seat stadium.

The report outlines a set of parking, transit service and highway traffic management strategies that would be most effective at the two potential Megaplex locations.

For the purposes of planning transportation service to proposed baseball park, the Megaplex report is most illuminating in its presentation of mode choice information from other US baseball parks.

Table 2.7

Baseball Stadium	Percent of Stadium Fans Travelling by private automobile	Year of Report
Fenway Park, Boston	68%	1983
Kingdome, Seattle	70%	1982
Shea Stadium, New York	65%	1990
Yankee Stadium, New York	40%	1990

The same report also presented some useful information of the average private vehicle occupancy rate for baseball fans at various stadiums.

Table 2.8

Baseball Stadium	Average persons per Automobile	Year
Fenway Park, Boston	3.3	1983
Kingdome, Seattle	2.4 -3.5	1982
Astrodome, Houston	3.2	1993
Dodger Stadium, LA	3.0	1993

Finally the study reports on a survey of 24 major league baseball stadiums that indicated the range of seats to onsite parking spaces ranged between 2.1 and 50 seats per space. Among reported stadiums the indicated average was 6.7 seats per on site parking space.

Table 2.9

Seats per Parking Space at 24 Major League Baseball Stadiums			
On Site Parking Only			All Parking
Minimum	Maximum	Average	Average
2.1	50.0	6.7	3.1

Most stadiums also rely on an inventory of parking that is not on the stadium site. The reported major league average is 3.1 seats per parking space in the team's parking inventory. The parking inventory for the average major league baseball park is reported at 22,400 spaces including all available spaces in the vicinity.

Parsons Brinkerhoff, Quade & Douglas, Transportation Assessment of the Proposed Stadium Site at Broad and Spring Garden Streets, Submitted to Philadelphia Phillies, May 1999 (Source: TRB Contacts)

This 22-page report provides a transportation assessment of a Center City site for a proposed new 45,000 seat baseball in downtown Philadelphia. The new stadium is proposed to replace the existing multi-use Veteran's stadium, which is approximately three miles south of downtown.

The study reports the baseball mode split to the current facility is 8% transit for weekly night games and 4% transit for weekend games.

The study also evaluated parking availability downtown for a weeknight game. It determined that with an average vehicle occupancy of 2.5 fans per private automobile that a capacity crowd would require a transit mode of split up to 35% to avoid a parking shortage. The study team appeared to view a transit mode split goal of 20% as more realistic for the downtown Philadelphia ballpark.

Abrams Steven H. "Moving Crowds in Chicago: Baseball and the 4th of July" presented at the 79th Annual Meeting of the Transportation Research Board. Washington DC January 2000 (Source: TRB)

This 15-page paper by a Senior Transit Operating Engineer with the Chicago Transit Authority describes the services that the CTA offers to serve baseball crowds at Chicago's Wrigley Field. The 39,000-seat stadium was opened in 1914 as a 14,000 seat stadium an era which predated the private automobile. Parking in the neighborhood of the stadium is scarce, "Cubs fans have been encouraged to use public transit." A single rapid transit station served by a local and an express line serve the Wrigley Field. Over the last decade as the stadium crowds have grown, the CTA has expanded the station to allow more patrons to comfortably wait on the platform after games and changed its fare collection strategy to increase throughput at the turnstiles.

The line serving Wrigley Field generally operates with 8-car rapid transit trains at 10-minute headway. The line operates with five-minute headways when the end of the ballgame coincides with rush hour. This coincidence is fairly common since only 18 night games are played each year at Wrigley.

One municipal transit service that CTA offers to ballgame patrons is unique. For the 18 night games each year, a special CTA bus service is offered connecting with remote lots 3.2km (2 miles) from the stadium. The \$5.00 parking fee pays for parking and a round trip bus trip for all occupants of each parked car. The remote lots are public school parking lots. Five CTA buses are routinely assigned to this service.

The paper does not present any information on mode split to Wrigley Field.



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Fenway Park Game Day Service Improvement Study

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SUBJECT: **Technical Memo #3:**
Review of Current MBTA Game Day Services

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Introduction and Summary

Under subcontract to Stone and Webster Engineers, KKO and Associates, LLC is conducting four analyses for the Massachusetts Bay Transportation Authority concerning potential improvements in transit service to improve accessibility for baseball fans to Fenway Park in Boston. The analyses are to be documented in four technical memoranda.

This technical memorandum documents the findings of the review of current game day services provided by MBTA. This memorandum also contains:

- Available data on observed demand for existing MBTA game day services,
- A comparison of Red Sox game day services provided by MBTA with MBTA services to other special events, and
- A brief description of the new Fenway - Ruggles shuttle which is provided by the Red Sox using a private bus carrier.

Current MBTA game day services consist of ordinary MBTA service¹ augmented with

- extra Green Line service;
- extra bus service;

¹ Services that are provided whether or not there is a Red Sox game

- limited commuter rail service at Yawkey Station;
- extra supervisory, police, and revenue personnel at key locations; and
- coordination of MBTA services with those of the private shuttle carrier and with the timing of the ballgame.

Table 3.1
Ordinary MBTA Service to the Kenmore/Fenway Park Area

Service	Description
Green Line	Service to downtown and on Boston College, Cleveland Circle, and Riverside routes.
Bus 8	University of Massachusetts – Kenmore via South End Medical Center, Dudley, Ruggles, and Longwood Medical Center
Bus 47	Central Square Cambridge - Albany Street via BU bridge, Kenmore, Ruggles, Dudley, and South End Medical Center
Bus 55	Jersey and Queensbury - Copley Square
Bus 57	Watertown – Kenmore via Newton Corner and Brighton Center
Bus 60	Chestnut Hill – Kenmore via Route 9 and Brookline Village
Bus 65	Brighton Center - Kenmore via Brookline Village
Bus CT-1	Kendall Square Cambridge - Ruggles via BU bridge, Fenway Station and Longwood Medical Center

These MBTA services are provided to the Fenway Park area whether or not there is a Red Sox game.

Table 3.2
Additional Red Sox Game Day Services Provided by MBTA

Service	Description
Green Line	Thirteen extra cars post-game
Bus 57	Two extra buses post-game
Commuter Rail (Weeknight games)	Regular Framingham line trains stop at Yawkey station (two trains pre-game inbound and two trains post-game outbound).
Commuter Rail (Weekend day games)	Regular Framingham line trains stop at Yawkey station (one train pre-game inbound and one train post-game outbound). Regular Attleboro line trains continue to Yawkey station (one train pre-game inbound and one train post-game outbound).
Supervision	Coordination between Operations Control Center, Red Sox, and Amtrak. Six extra officials and three Subway Supervisors stationed at stations near ballpark and at Ruggles station. Coordination at Ruggles with Red Sox' private shuttle bus.
Station Staffing	Additional staffing at token booths and gates at key stations.
MBTA Police	Twelve to fourteen additional officers at stations near ballpark and on Green Line

MBTA augments its ordinary service on Red Sox game days.

All together the MBTA services provide transportation for slightly less than one-quarter of the fans attending a home Red Sox game.

By comparison with Red Sox game day services, MBTA sometimes provides extensive special services for unusual events. Many of these events involve substantial MBTA assets in event-dedicated service. The MBTA also operates special trains to the Patriot's home football games in Foxborough. Each of these events differs from Red Sox weeknight games in that they either:

- do not coincide with normal rush-hour peak demand on the MBTA, or
- are short-term, one-time events which allow MBTA to schedule use of assets that would normally be undergoing scheduled maintenance.

This year the Red Sox are supplementing MBTA service to Fenway Park with a free shuttle between the ballpark and Ruggles Station. The free private bus shuttle, funded by the Red Sox, serves the Orange Line and commuter rail. This service is very new and reported ridership has varied widely from game to game. Over the first 17 home games of the season it ranged between 798 and 98 passengers to the game. Ridership levels on this new service may take a season or more to stabilize.

Purpose and Scope

This task documents the transit services that currently are (and are not) offered to Red Sox stadium fans. It also reports estimates of demand for these services. Both are reported to provide the basis for formulating new transit options that are to be evaluated in Task 4 of this project.

KKO assembled and reviewed MBTA game day operating data from:

- MBTA schedules,
- MBTA operating procedures relating to games at Fenway Park,
- Telephone interviews with operations planning and commuter rail personnel, and
- MBTA promotional literature relating to Red Sox games.

KKO obtained and analyzed demand data from:

- 1999 CTPS ridership counts,
- 1994 and 1996 survey data provided by the Red Sox,
- August 1999 and November 1999 planning documents generated by the Red Sox,
- 1999 conductors' ridership counts for MBTA commuter rail trains, and

- Data supplied by Red Sox' consultants regarding the Ruggles Shuttle.

The findings of those reviews and analyses generally pertain to 7:05 pm weekday night games and to 1:05 pm weekend afternoon games. These two game times constitute 88% of the 81 Red Sox home games:

Table 3.3
Typical distribution of Red Sox home games by day and time.

Day and time	Number of games
7:05 pm weekday night games	47
1:05 pm weekend afternoon games	24
other weekday games	8
other weekend games	2

Generally 88% of Red Sox home games start at 7:05 weeknights or 1:05 weekends.

The remainder of this technical memorandum is divided into four sections:

1. Existing MBTA game day services,
2. Observed demand for existing MBTA services,
3. Comparison with other MBTA special event services, and
4. The Red Sox' private-carrier Ruggles shuttle.

1. MBTA Game Day Services

Current MBTA game day services include ordinary MBTA service on the Green Line and on seven bus routes that serve the Fenway Park area. These baseline services are supplemented with extra Green Line cars; extra buses; and limited commuter rail service to Yawkey Station.

Pre-Game Services – MBTA service to Fenway Park before baseball games primarily consists of existing subway and bus operations, augmented with some additional personnel. Except for the commuter rail service from Framingham to Yawkey station, the MBTA provides no extra pre-game bus, Green Line, or commuter rail transportation service to help transport fans to the stadium. No additional inbound weekday commuter rail service is offered at Ruggles². No outbound weekday Framingham/Worcester line trains are stopped at Yawkey (to provide service from other commuter rail lines and from downtown). For weeknight games (at 7:05 pm), pre-game travel to Fenway Park coincides with the later portion of the normal evening "rush-hour".

² On the Needham, Franklin, Attleboro/Providence, or Stoughton lines.

Post Game Service – The MBTA does routinely provide substantial special post-game service to handle the surge of fans seeking transportation after the game. For post-game service, when ridership demand is concentrated into a shorter period, the MBTA deploys thirteen extra Green Line cars (and operators) and two extra buses (and operators) to provide extra capacity for fans. Post-game commuter rail service is limited special stops added to regularly-scheduled trains; unlike MBTA's service to events at Foxborough Stadium, there are no dedicated post-game commuter rail trains that are guaranteed not to depart until after a late-running game ends.³

Since the advent of the Red Sox' Ruggles Shuttle in the spring of 2000, the MBTA has adjusted some commuter rail schedules to provide station stops outbound at Ruggles late in the evening. These trains now stop at Ruggles every night and are not formally part of the special post-game services.

Weekday Day Games - For the eight weekday afternoon games scheduled in a typical year, MBTA provides the same post game bus and subway services described above. It also schedules the two regular peak hour outbound Framingham line trains to make special stops at Yawkey at 4:40 and 5:15 pm to serve post-game patrons.

Other Provisions - MBTA augments its Red Sox game day service with extra supervisory, police, and revenue personnel at key locations; and by close coordination of MBTA services with those of the Red Sox' private carrier Ruggles shuttle and with the timing of the ballgame:

- The Operations Control Center duty supervisor coordinates all MBTA game day activities and ensures (90 minutes prior to game time) that all necessary personnel and equipment are available.
- The Operations Control Center duty supervisor establishes direct telephone coordination with a designated person in Red Sox management at Fenway Park. This is augmented by radio or television monitoring of the progress of the game by OCC personnel.
- The Operations Control Center duty supervisor establishes similar coordination with the Amtrak south side dispatcher whenever night games appear that they will extend late enough to warrant delays to trains Framingham trains 585 or 537.
- The Green Line provides six extra officials (one at Blandford Street, one at Fenway, four at Kenmore).

³ When night games run late, MBTA will delay the departure of regular outbound Framingham/Worcester line trains by up to 30 minutes; no similar provisions are in place for outbound trains serving Ruggles station.

- In addition to the Green Line officials, the on-duty supervisors of the Green, Orange and Red Lines are stationed respectively at Kenmore, Ruggles and Fenway stations.
- Bus operations provides additional supervision at Kenmore.
- The Orange Line provides personnel at Ruggles station to facilitate the movement of passengers between the Red Sox' private shuttle service and the Orange Line and commuter rail lines.
- Additional staffing is provided at token booths and gates at Riverside and Kenmore.
- Twelve to fourteen additional MBTA police officers are stationed at Kenmore, Fenway, and Yawkey stations and on board the Green Line.

Details on the game day services are provided in Tables 3.4 through 3.7.

Table 3.4
Weekday Evening Games (Pre-game to Fenway)

	Ordinary Service		Extra game day service
	Headways (minutes)	Arrival times	
Direct Services			
Green Line from downtown	2		None
Green Line from Riverside	5		None
Green Line from Cleveland Circle	6		None
Green Line from Boston College	5		None
Bus 8 (UMass - Kenmore via Ruggles)	20		(Rerouted from Brookline Ave.)
Bus 47 (Central Sq - Albany St. via Ruggles)	25		None
Bus 55 (Jersey & Queensbury – Copley)	30		None
Bus 57 (Watertown - Kenmore)	10		None
Bus 60 (Chestnut Hill - Kenmore)	24		(Rerouted from Brookline Ave.)
Bus 65 (Brighton Center – Kenmore)	24		(Rerouted from Brookline Ave.)
Bus CT-1 (Kendall - Ruggles)	20 - 30		None
Commuter rail Framingham – Yawkey		None	Train 524 arrives 6:15 pm; train 528 arrives 7:05 pm.
Commuter rail Attleboro -Yawkey		None	None
Connecting Services			
Commuter rail Needham - Ruggles		None between 1:24 and 7:49 pm	None
Commuter rail Franklin – Ruggles		None after 12:52 pm	None
Commuter rail Attleboro - Ruggles		None after 2:41 pm	None
Commuter rail Stoughton - Ruggles		None	None
Orange Line to Ruggles	5		None
Red Line to Kendall & Central	4		None

Table 3.5
Weekday Evening Games (Post-game from Fenway)

	Ordinary Service		Extra game day service
	Headways (minutes)	Departure times	
Direct Services			
Green Line to downtown	3		6 RAD cars Kenmore - Park St; 4 cars stored at Upper Yard
Green Line to Riverside	10		3 cars stored at Kenmore loop.
Green Line to Cleveland Circle	10		None
Green Line to Boston College	8		None
Bus 8 (UMass - Kenmore via Ruggles)	34		(Rerouted from Brookline Ave.)
Bus 47 (Central Sq - Albany St. via Ruggles)	45		None
Bus 55 (Jersey & Queensbury - Copley)	30		None
Bus 57 (Watertown - Kenmore)	15		Two RAD buses after game.
Bus 60 (Chestnut Hill - Kenmore)	30		(Rerouted from Brookline Ave.)
Bus 65 (Brighton Center - Kenmore)	None		(Rerouted from Brookline Ave.)
Bus CT-1 (Kendall - Ruggles)	None to Ruggles, 30 to Kendall		None
Commuter rail Yawkey – Framingham		None	Train 585 departs 10:15 pm; Train 537 departs 11:15 pm*.
Commuter rail Yawkey - Attleboro		None	None
Connecting Services			
Commuter rail Ruggles - Needham		Train 635 @ 10:38 pm	None
Commuter rail Ruggles - Franklin		Train 635 @ 10:28 pm	None
Commuter rail Ruggles - Attleboro		Train 825 @ 10:33 pm Train 827 @ 12:07 am	None
Commuter rail Ruggles - Stoughton		Train 929 @ 11:08 pm	None
Orange Line from Ruggles	13		None
Red Line from Kendall & Central	6		None

*Train 585 continues beyond Framingham to Worcester.

*Train 585 will be held as late as 10:45 pm; train 537 will be held as late as 11:40 pm for late games.

Table 3.6
Weekend Afternoon Games (Pre-game to Fenway)

	Ordinary Service		Extra game day service
	Headways (minutes)	Arrival times	
Direct Services			
Green Line from downtown	2		None
Green Line from Riverside	6		None
Green Line from Cleveland Circle	7		None
Green Line from Boston College	7		None
Bus 8 (UMass - Kenmore via Ruggles)	50		(Rerouted from Brookline Ave.)
Bus 47 (Central Sq - Albany St. via Ruggles)	25		None
Bus 55 (Jersey & Queensbury - Copley)	30		None
Bus 57 (Watertown - Kenmore)	10		None
Bus 60 (Chestnut Hill - Kenmore)	30		(Rerouted from Brookline Ave.)
Bus 65 (Brighton Center - Kenmore)	36		(Rerouted from Brookline Ave.)
Bus CT-1 (Kendall - Ruggles)	None		
Commuter rail Framingham – Yawkey		None	Train 1506 arrives 12:35 pm
Commuter rail Attleboro -Yawkey		None	Train 1806/1507 arrives 12:41 pm
Connecting Services			
Commuter rail Needham - Ruggles*		Train 1604 @ 10:27 am Train 1606 @ 12:27 pm	None
Commuter rail Franklin - Ruggles		None	None
Commuter rail Attleboro - Ruggles		Train 1806 @ 12:22 pm	None
Commuter rail Stoughton - Ruggles		None	None
Orange Line to Ruggles	10		None
Red Line to Kendall & Central	7		None

*Saturday only on Needham Line

Table 3.7
Weekend Afternoon Games (Post-game from Fenway)

	Ordinary Service		Extra game day service
	Headways (minutes)	Departure times	
Direct Services			
Green Line to downtown	2		6 RAD cars Kenmore - Park St; 4 cars stored at Upper Yard
Green Line to Riverside	6		3 cars stored at Kenmore loop.
Green Line to Cleveland Circle	5		None
Green Line to Boston College	7		None
Bus 8 (UMass - Kenmore via Ruggles)	50		(Rerouted from Brookline Ave.)
Bus 47 (Central Sq - Albany St. via Ruggles)	25		None
Bus 55 (Jersey & Queensbury - Copley)	30		None
Bus 57 (Watertown - Kenmore)	10		Two RAD buses after game.
Bus 60 (Chestnut Hill - Kenmore)	32		(Rerouted from Brookline Ave.)
Bus 65 (Brighton Center - Kenmore)	30		(Rerouted from Brookline Ave.)
Bus CT-1 (Kendall - Ruggles)	None		
Commuter rail Yawkey – Framingham		None	Train 2511 departs 4:40 pm
Commuter rail Yawkey - Attleboro		None	Train 1510/1811 departs 4:20 pm
Connecting Services			
Commuter rail Ruggles - Needham*		Train 1611 @ 5:18 pm Train 1613 @ 7:18 pm	None
Commuter rail Ruggles - Franklin		None	None
Commuter rail Ruggles - Attleboro		Train 1811 @ 4:53 pm Train 1813 @ 6:53 pm	None
Commuter rail Ruggles - Stoughton		None	None
Orange Line from Ruggles	10		None
Red Line from Kendall & Central	7		None

*Saturday only on Needham Line

The following notes apply to Tables 3.4 through 3.7:

1. In addition to local service, buses 8, 47, and CT-2 provide service between Ruggles and Kenmore. However, these routes are slower, less direct and operate less frequently than the Red Sox' Ruggles shuttle.
2. Buses 47 and CT-2 provide connections between the Red Line and the Fenway Park area. However, direct subway connections between Red and Green Lines via Park Street are usually faster for potential riders.
3. For Red Sox patrons, bus 55 effectively duplicates the Green Line route between downtown and Fenway Park, but at a half-hourly headway.
4. Bus 57 (which follows the former route of the Green Line "A" trains to/from Watertown) is a heavily patronized route providing a relatively direct trip between the ballpark and the Watertown, Newton Corner, Brighton, and Allston communities. This bus makes limited stops along Commonwealth Avenue east of the intersection of Commonwealth and Brighton Avenues.
5. For Red Sox patrons, bus 60 effectively duplicates the Green Line route between Chestnut Hill, Brookline Village, and Fenway Park, but generally operates at a 30-minute headway.
6. Bus 65 crosses three branches of the Green Line, but operates at long headway. The Green Line is generally more direct and faster to the Fenway Park area.
7. Bus CT-2 provides limited service after early evening, and cannot be taken from the Fenway Park area toward Ruggles in the late evening. Bus CT-2 does not provide weekend service.
8. The six run-as-directed cars indicated for post-game Kenmore-Park Street service are stored at Blandford Street on the Commonwealth Avenue line. As such, they cannot readily access the Kenmore Loop and cannot be used for outbound service until they have traveled inbound to Park Street.
9. The three run-as-directed cars stored on the Kenmore loop are effectively limited to service on the Riverside or Cleveland Circle lines. They cannot readily access the Commonwealth Avenue line or be used for inbound service.
10. The four cars stored at Upper Yard (near Reservoir) run inbound to Kenmore and can then be used either as inbound cars to downtown or as outbound cars on the Riverside or Cleveland Circle lines.

2. Observed Demand for MBTA Transit Services

Introduction and summary - Three sets of data were obtained by KKO to analyze demand for current MBTA game day services for Fenway Park:

- CTPS counts at major Green Line stations and Yawkey Station
- Commuter rail counts for the Worcester/ Framingham Line in 1999
- Red Sox survey data⁴ as well as the attendance and dates for all home games in 1999.

KKO analyzed these data sources in order to develop the most comprehensive picture of the MBTA's ball-game-related ridership demand possible.

Table 3.8
Summary of Observed and Surveyed Modal Splits

Source	Red Sox Fan Survey (1996)	Red Sox Transportation Improvements Plan ⁵ (1999)	CTPS counts (1999)	Amtrak conductors counts (1999)
Mode	Mode share	Mode share	Mode share	Mode share
Car/truck/RV	68.0%	68%		
MBTA*	18.5%	20%	23.8%	
Commuter rail	3.6%	3%	0.65%**	0.33%*
Charter bus	3.5%	3%		
Walked and other	6.4%	6%		

* Red Sox figures for MBTA include both Green Line and Bus; CTPS figures are Green Line only.

** Yawkey Station only, does not include riders transferring to subway or bus at North, South, Back Bay, Porter Square, Malden, Braintree, or Ruggles stations.

KKO could not determine the dates of the Red Sox surveys or whether the data pertains to weekend games or weeknight games. No information was provided indicating if and how mode split varies between weekend games and weeknight games.

Both the CTPS counts and the Amtrak conductors counts indicate that commuter rail ridership is less than the 3.6% estimated from the 1996 Red Sox survey. However, since the CTPS and Amtrak counts pertain only to Yawkey station, the seeming discrepancy may be potentially explained. Note that some patrons who indicated "commuter rail" in the Red Sox survey may

⁴ A Red Sox consultant conducted in-park surveys of patrons one day each in 1994, 1995, and 1996.

⁵ The 1999 Red Sox Transportation Improvement Plan cites the 1996 survey but uses 20% (rather than 18.5%) for the MBTA (bus and subway) share of the mode split.

have taken commuter rail to North, South, or Back Bay stations and then transferred to the subway. Thus these fans may have been 'self-identified' as commuter rail patrons in the survey but counted as subway passengers by CTPS. In addition to paying fans attending the ballgame, there are an unidentified number of persons who travel to the study area on game days to serve the crowds. This additional game day traffic is also included in the CTPS counts.

All data support the general assertion that 18% to 23% of fans arrive and leave the Fenway Park area via MBTA subway or bus services and that less than one percent arrive or leave via the Yawkey Station service.

The following pages provide further details of the data and analysis used to generate the summary data in Table 3.8.

CTPS Counts -In July 1999, the Central Transportation Planning Staff (CTPS) counted passengers at the principal Green Line and commuter rail stations that could serve Fenway Park. CTPS made boarding and alighting counts at Kenmore, Blandford, Fenway stations on the Green Line and at Yawkey Station on the Worcester/Framingham Line. At Green Line stations two sets of counts were conducted; one game day and one non-game day in order to estimate the baseball related ridership by comparing the game and non-game days.

Table 3.9
Weekday Ridership Difference Between Game and No Game Days
(source: CTPS)

Date	Station	To Game	From Game
July 20 and 27, 1999	Kenmore	4,435	4,117
July 22 and 29, 1999	Fenway	1,566	826
July 21 and 28, 1999	Blandford	44	131
Green Line Total		6,045	5,074
July 20, 1999	Yawkey Station ⁶	164	199

Commuter Rail Counts - Amtrak provided KKO with its 1999 conductor's ridership counts for the trains that serve Yawkey on the Worcester/ Framingham Line. KKO compared reported total ridership on game days with reported ridership on non-game days for the baseball season (April through September). Table 3.10 lists the specific trains that serve Yawkey Station for weekday night and weekend games.

⁶ Counts only for game day

Table 3.10
MBTA Service to Yawkey Station

	Trains to game	Trains From game	Number of Games
Weekday	524 Arrives 6:15 from Framingham 528 Arrives 7:05 from Framingham	535 Departs 10:15 to Framingham 537 Departs 11:15 to Framingham	47
Saturday	1506 Arrives 12:35 from Framingham 1507 Arrives 12:45 from So Attleboro	1510 Departs 4:20 to So Attleboro 1511 Departs 4:40 to Framingham	12
Sunday	2506 Arrives 12:35 from Framingham 2507 Arrives 12:45 from So Attleboro	2510 Departs 4:20 to So Attleboro 2511 Departs 4:40 to Framingham	12

Table 3.11 reports the results of the weekday comparison between game and non-game days during 1999. On weeknights the average estimated ridership to Yawkey for baseball games is 100 passengers with an average of 96 passengers using commuter rail to return westward after the game.

Table 3.11
Weekday Nights
Average Reported Ridership on Trains Serving Yawkey Station
For Game Days and Non-Game Days
(1999)

	Train	Average Game Day	Average Non-Game Day	Average Difference
Weekdays	524	402	330	72
	528	148	121	28
	Pre Game to Fenway			100
	535	238	189	49
	537	195	148	47
	Post Game From Fenway			96

Table 3.12 reports the averages for weekend day games. On Saturdays, it is estimated that an average of 65 passengers arrived by commuter rail at Yawkey and average of 128 left Yawkey on commuter rail. On Sundays, it is estimated that an average of 104 fans arrived by rail at Yawkey and an average of 52 fans left Yawkey by rail.

Table 3.12
Average Reported Ridership on Trains Serving Yawkey Station
For Game Days and Non-Game Days
(1999)

	Train	Average Game Day	Average Non-Game Day	Average Difference
Saturdays	1506	452	397	55
	<i>1507</i>	238	227	10
	Pre Game to Fenway			65
	<i>1510</i>	277	202	75
	1511	320	267	53
	Post Game From Fenway			128
Sundays	2506	414	346	68
	<i>2507</i>	225	189	36
	Pre Game to Fenway			104
	<i>2510</i>	241	229	12
	2511	337	297	40
	Post Game From Fenway			52

On weekends, service is offered from both Framingham and South Attleboro. The South Attleboro trains are highlighted in *italics* in Table 3.12. Usage of the South Attleboro trains is generally less substantial than the Framingham trains. Overall weekend commuter rail ridership to and from Yawkey is somewhat lighter than weekdays.

Red Sox Attendance Data - As reported in the 1999 transit plan citing the 1996 fan survey, the Red Sox indicate that 3% of the fans surveyed at a game used commuter rail to get to Fenway Park, and 20% used MBTA bus or subway. The Red Sox also provided attendance figures for all home games in the 1999 season. The average attendance at a ballgame for the games that were served by commuter rail service is 89% of the total capacity of 33,871 seats.

Table 3.13
Red Sox 1999 Attendance for Home Games Served by Commuter Rail
47 weekday night games, 24 weekend day games

	Average	Max	Min
Weekday	29,928	33,777	20,960
Saturday	31,827	33,253	26,785
Sunday	30,188	32,460	23,710
Total	30,289	33,777	20,960

Demand Analyses: Commuter Rail - For July 20, 1999 KKO was able to assemble attendance counts from the Red Sox, CTPS counts at Yawkey Station, and averaged commuter rail ridership data. These data are arrayed in Table 3.14. In 1999, the estimated share of commuter rail share of total fans arriving at Fenway Park by commuter rail was less than the estimate developed from the Red Sox 1996 fan survey, closer to 1% and much less than the 3% estimated using 1996 data.

Table 3.14
Commuter Rail Mode Share

Source	Attendance	Used Commuter Rail ⁷	Percentage Use
Red Sox survey			3%
CTPS 7/20/99	25,346	164	0.65%
Commuter Rail (weekday averages)	29,928	100	0.33%

⁷ Pre-Game inbound travel

Demand Analyses: Green Line - The estimated mode share based on CTPS' 1999 counts is somewhat higher than the estimate prepared from the 1996 Red Sox fan survey. The Red Sox 20% figure includes both subway and bus ridership. The CTPS count refers only to Green Line users. The CTPS estimates include all persons using Green Line station near Fenway Park on game days. Consequently they may include some riders that were not paying fans attending the game. These extra riders may include extra personnel who work in the area on game days and fans who come to celebrate the game outside the park.

Table 3.15
Subway Mode Share

Source	Attendance	Used Subway ⁸	Percentage Use
Red Sox (1996) ⁹			20%
CTPS (July 1999)	25,346	6,045	23.8%

3. Comparing MBTA Red Sox Service with MBTA Service for Other Special Events

MBTA often provides special services for other events including various games and concerts at Foxboro Stadium, the 1999 Baseball All Star Game at Fenway Park, the 1999 Ryder Cup in Newton, the annual "First Night" celebration, the Fourth of July Pops concert in Boston, and major events in Boston Harbor. As is briefly described below, many of these events involve the assignment of substantial MBTA assets to event-dedicated service.¹⁰

A significant difference between these events and additional MBTA pre-game service for Red Sox weeknight games is that they either:

- do not coincide with normal rush-hour peak demand on the MBTA, or
- are short-term, one-time events around which MBTA can reschedule vehicle maintenance in order to enable the use of assets that would normally be undergoing programmed maintenance.

Foxborough Stadium Patriots Games – The MBTA has operated special service to New England Patriots games on a regular basis for several years. Usually two trains are run. This is a dedicated special service, and not an extension of other scheduled trains. Accordingly, passengers are assured that the return train will not leave prior to a fixed time (usually 30 minutes) after the game ends -- even if there is an overtime period. Since most Patriots games are on Sundays, equipment availability is not an issue. For infrequent Monday night games, the train sets are made available by using cars that would normally have been scheduled for regular maintenance.

⁸ Inbound travel

⁹ Subway and bus percentage

¹⁰ While these services are reportedly well patronized, specific ridership figures were not made available to KKO.

Patriots games (and other events at Foxborough Stadium) differ from Red Sox games both because there is a larger stadium capacity, and because they involve a "reverse commute" (from the city to an event in the suburbs rather than from the suburbs to an event in the city).

Foxborough Stadium World Cup Soccer – In 1994 the MBTA operated service to Foxborough Stadium for World Cup soccer games. As with Patriots Games, this service involved special dedicated trains and an assurance that return trains would not leave until after the end of the game. Trainsets were made available through a combination of off-peak operation and rescheduled maintenance.

Baseball All-Star Game at Fenway Park – In July 1999, The MBTA operated a commuter rail shuttle between downtown and the baseball All-Star Game at Fenway Park. A dedicated trainset provided the service, which -- due to other related All-Star events -- overlapped the actual game starting and ending times by a number of hours. Because of signal restrictions outbound trains continued west to a point beyond the CP3 interlocking before reversing direction. This, along with track speeds, limited the service using a single train set to one round trip every 50 minutes. The train set used for this special service was made available by using cars that would normally been scheduled for regular maintenance.

Fourth of July Concert and First Night -- MBTA operates extra late night service for both of these downtown events using bus, commuter rail, and subway equipment that is normally not in use late in the night on a holiday. Maintenance schedules are altered so that the number of available subway cars exceeds that available during normal rush hour service. In most years, MBTA's highest ridership falls on these two dates.

1999 Ryder Cup -- MBTA operated extensive bus service to the 1999 golf event using buses that would normally have been in scheduled maintenance and by using a "contingency fleet" of buses that had been held over beyond their scheduled retirement from service.

Other Special Events -- MBTA operates special services for other special events. The summer, 2000 events include three rock and roll concerts at Foxboro, women's Gold Cup Soccer at Foxborough, Harborfest, and Operation Sail in Boston Harbor. Each of these events differs from the Red Sox night game schedule. They are short-term events that do not require the assignment of dedicated assets on a long-term basis.

4. The Red Sox Ruggles Shuttle

This season the Red Sox have initiated a new transit service to the ballpark. The service links Ruggles Station served by the MBTA Orange Line and various commuter rail lines with Fenway Park. The free private bus shuttle, funded by the Red Sox is very new¹¹. It seems too early to determine with certainty how much ridership it will eventually achieve. Although this shuttle is technically beyond the scope of a review of MBTA services to Fenway Park, the following discussion is presented because of its potential impact on Orange Line and commuter rail service and upon bus routes 8, 47, and CT-2.



Figure 3.1
Red Sox Shuttle Bus near Ruggles Station (June 29, 2000)

The service uses a fleet of private sector buses that operate express between Ruggles station and the ballpark. Service runs on 10-minute headways from 1 1/2 hours before the game to 1 hour after the game. MBTA provides game day coordination of passenger movements at Ruggles station between the shuttle and commuter rail and Orange Line services. After initial operating issues on congested streets near the ballpark, the service received permission to operate on nearby parkways that are normally restricted to commercial vehicles.

Some data were made available to KKO showing the results of the six weeks (17 home games) for the Red Sox' Ruggles shuttle.

Trip Time - Trip time during the first months of operation has generally varied from 5 minutes to 30 minutes to the game and from 4 minutes to 20 minutes from the game. The longest trip times experienced were for weeknight games. Weekend trips did not exceed 18 minutes.

Ridership - Ridership to the game during the first 17 home games (April 11 through May 25) ranged from 98 to 793 riders, with an average of just under 300 passengers per game. (Only one game, a Saturday contest against the Blue Jays in May attended by 24,579 fans, exceeded 450 inbound passengers.) Ridership from the game tends to be lower, ranging between 88 and 338 passengers with an average of approximately 180 passengers per game.

¹¹ The shuttle began on April 11, 2000.

Table 3.16
Ruggles Shuttle Ridership Performance
(17 Games April-May 2000)

	Maximum Ridership	Minimum Ridership	Average Ridership
Pre Game Service	793	98	295
Post Game Service	338	88	180

Fan Trip Characteristics - Surveys taken aboard the shuttle indicate that (by mid-May) over 15% of the riders on the shuttle were repeat riders. 78% indicated that their trip to the ballpark originated at home rather than at work.

Mode of Access - The same survey asked how Ruggles Shuttle passengers arrived at Ruggles before the game. It was reported that

- 62% took the Orange Line to Ruggles station,
- 5% took commuter rail,
- 8 % took an MBTA bus,
- 13% drove to Ruggles, and
- 12% walked.

Shuttle Impact - No information has been developed to determine the impact of this shuttle on travel to the ballpark by other modes. In particular, it is not clear how many of the Ruggles Shuttle riders would be Green Line patrons and how many would be automobile based fans in the absence of the new shuttle.



Technical Memorandum

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Coordination, Planning and Conceptual Design Services
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Fenway Park Game Day Service Improvement Study

AUTHORS: Gerry Pieri and David Nelson

SUBJECT: **Technical Memo #4:**
Identification and Evaluation of Modal Strategies

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4.1. Introduction and Summary

Under subcontract to Stone and Webster Engineers, KKO and Associates, LLC conducted four analyses for the Massachusetts Bay Transportation Authority concerning potential improvements in transit service to improve accessibility for baseball fans to Fenway Park in Boston. The analyses are documented in four technical memoranda.

This technical memorandum identifies and evaluates several modal strategies that could be pursued to improve transit system performance on game days. For each evaluated strategy, this memorandum contains:

- a description of the strategy,
- an estimate of the size of total market served,
- an estimate of the market potential,
- an estimate of costs and revenue, and
- identification of unresolved details and other considerations.

Evaluated MBTA game day strategies fall into three categories:

1. Institutional changes involving neither substantial operational changes nor substantial capital investment.
2. Operational changes involving little or no capital investment.
3. Changes involving substantial capital investment.

Nineteen strategies were evaluated in detail. Of these, KKO:

- Recommends immediate action to implement or preserve options for four strategies;
- Recommends experimental implementation of nine strategies in 2001 or future years;
- Recommends further evaluation or planning of four strategies;
- Does not recommend pursuing two strategies.

Recommendations

1. KKO recommends that the MBTA and the Red Sox work together to provide bundled ticketing on an experimental basis during the next baseball season.
 - "Free" transit tickets would be provided with each game admission ticket. The cost of each free ticket would be incorporated into the game ticket price as a hidden surcharge of approximately \$.50. All stadium fans would pay for transit whether they use it or not. The MBTA would be paid only for stadium fans who actually use MBTA services. Non-users of the MBTA would in effect subsidize transit use to ballgames.

- Bundled ticketing may be the most efficient means to increase game day transit ridership. This strategy could divert more than 3,000 fans (nearly 1,000 automobiles) per game from car to transit without major costs or risks to either the Red Sox or the MBTA.
 - To achieve desired modal diversion, this strategy must be supported with comprehensive dissemination of user-specific information how to use the MBTA. This information should be aimed at persons who do not normally use MBTA services.
2. KKO recommends that the MBTA act promptly to preserve both its commuter rail and Green Line capacity enhancement options on rail or former rail property near the ballpark. The inactive rail line running between Fenway and Yawkey stations can be used for
1. a commuter rail turnback station with storage tracks, and/or
 2. Green Line storage on the Highland branch near Fenway station

The required vacant land is protected for transportation use by MGL §40-54A, and adaptable to designs that will protect both the MBTA's needs and the desires of others for air rights and adjacent development. The MBTA, with the EOTC, has substantial leverage to achieve "win-win" solutions and to reduce capital costs for transit improvements in this area. As plans for area development progress, this opportunity will be reduced

3. KKO recommends that the MBTA immediately approach the City to ensure that the MBTA is an active participant in the planning of street and pedestrian access to the new ballpark.
- Currently the MBTA copes with game day automobile traffic by diverting bus routes away from the ballpark when the need for direct bus access to the ballpark is greatest.
 - Ideally, the shortest distance from a vehicle to the ballpark gates should be from a bus stop, and the first vehicle that a fan sees when leaving the game should be a bus ready to carry fans home.
 - At this time, plans for the new ballpark do not give meaningful priority to bus or transit vehicles.
 - Without active MBTA leadership, opportunities to incorporate bus access into the ballpark plans will reduce as the planning process continues.

KKO recommends nine strategies for possible experimental implementation in 2001 or future years:

1. Kingston commuter rail service
2. Pre-game commuter rail from South Station to Yawkey
3. Red Sox post-game events to flatten peak transit demand

4. Red Sox special pre-game events at Riverside
5. Longer Green Line trains dedicated to post-game service
6. Improved post-game service to North Station
7. Game day signage near Riverside
8. Subsidized transit for Red Sox employees and concessionaires
9. Coordinated commuter rail at Ruggles

Each of these requires marketing support aimed at stadium fans that are not regular MBTA commuters.

KKO recommends four strategies for further evaluation and planning before potential implementation:

1. Local measures to flatten post-game peak demand
2. Providence/Attleboro commuter rail
3. Commuter rail service to new turnback station
4. Express trains from Riverside to Kenmore

A summary of these 19 strategies organized by the nature of the option - institutional, operational or capital - follows in Tables 4.1, 4.2 and 4.3.

Table 4-1				
Summary of Institutional Options				
	Description	Impact on MBTA	Costs	Recommendation
A	Bundled ticketing	3,000 new round trip riders and \$11,500 new income per game.	\$2 million per year in charges to fans. Approximately \$0.54 per ticket sold.	Recommend implementation in 2001
B	Priority street access for MBTA buses	Substantial, but unquantified potential ridership	Minimal costs other than planning; possible reduced operating costs	Recommend immediate steps to preserve MBTA options
C	Post-game events in Fenway park	Leveled post-game peak at Kenmore	MBTA: none; Red Sox: unknown but small	Experimental implementation in 2001
D	Local post-game events outside Fenway Park	Leveled post-game peak at Kenmore	Minimal	Further study and evaluation
E	Red Sox pre-game events at Riverside	More paying riders on a route with available capacity	MBTA: minimal costs to provide facility; Red Sox: small promotional costs	Experimental trial at Riverside 2001
F	Game day signage near Riverside	More paying riders on a route with available capacity	No substantial costs	Experimental implementation at Riverside in 2001
G	Subsidized transit for Red Sox employees and concessionaires	300 to 700 round trip riders per game (many not at peak)	\$600 to \$1,400 per game paid by Red Sox and concessionaires	Experimental implementation in 2001

Table 4-2
Summary of Operational Options

	Description	Impact on MBTA	Costs	Recommendation
A	Kingston commuter rail service	Diversion of undefined percentage of 5,400 automobile riders	\$117,000 per season	Experimental operation in 2001.
B	Dedicated Providence/Attleboro commuter rail service	Diversion of undefined percentage of 3,600 automobile riders	\$107,000 per season	Operate as experiment in future years
C	Pre game commuter rail on existing trains from South Station to Yawkey	Diversion of undefined percentage of 8,900 automobile riders	Minimal	Operate experimentally in future
D	Longer Green Line trains dedicated to post game service	Capacity increase of at least 600 Green Line passengers	\$48,000 per season (\$597 per game)	Experiment in 2001
E	Improved post-game service to North Station	Unknown additional paying commuter rail and Green Line passengers	\$1,400 per season	Implement as experiment when North Station "super station" is available
F	Express trains from Riverside	Undefined percentage of 8,300 automobile riders	\$713 per train (trains scheduled only as needed to meet demand)	Experimental trial in 2001
G	Coordinated commuter rail at Ruggles	Unknown	Minimal	Experiment with minor changes in 2001
H	Express bus service from Fenway connecting with Red Line stations	Doubtful marketability	Twice the cost per rider as Green Line connection to Red Line	Not recommended

Table 4-3
Summary of Capital Options

	Description	Impact on MBTA	Costs	Recommendation
A	Commuter rail turnback station and train storage facility	Diversion of undefined percentage of 17,200 automobile riders	\$9.6 to \$10.4 million plus land costs	Recommend immediate preservation of physical options
B	Commuter rail service to new turnback station	Diversion of undefined percentage of 17,200 automobile riders	Approximately \$100,000 per season per route served	Future study - possible implementation based on results of Kingston and Providence experiments
C	Increased Green Line capacity at Fenway	Post-game Green Line capacity increase of 1,350 riders	\$820,000 capital plus land costs	Recommend immediate preservation of physical options
D	Increased weeknight pre-game capacity on Green Line	Pre-game Green Line capacity increase of 2,300 riders	\$130,000 per season for operating \$20 million capital	Not recommended

4.2. Purpose and Scope

This memorandum identifies and evaluates three groups of strategies to improve the scope and scale of transit services for game day traffic:

1. Institutional changes involving neither substantial operational changes nor substantial capital investment.
2. Operational changes involving little or no capital investment, and
3. Changes involving substantial capital investment.

For each evaluated strategy, this memorandum contains a description of the strategy, an estimate of the size of the total market served, an estimate of the market potential, and an estimate of potential costs. Some strategies are independent of each other. Others are interdependent and the interdependence is so noted. None of the strategies appear to be totally mutually-exclusive; however, instances where strategies may compete for the same assets are noted as such.

The identification of strategies was deliberately comprehensive. KKO initially identified a wide range of possible strategies without regard to their technical practicality, ultimate viability, or benefit-cost ratio. From this large group, KKO then chose the most promising strategies for evaluation. Appendix A describes identified strategies that were either not chosen for full evaluations or were rejected based on evaluation results.

The evaluations in this memorandum are based on available data on MBTA unit costs, ridership, potential market segments, technical items, and the experiences of peer properties. Detailed engineering analysis, site-specific marketing surveys, and independent demand modeling are beyond the scope of this task.

The remainder of this technical memorandum is divided into four sections:

- Methodology,
- Institutional strategies,
- Operational strategies (not requiring substantial capital investment), and
- Strategies involving substantial capital investment.

4.3. Methodology

This portion of the memorandum describes the methodology applied by KKO to develop and evaluate strategies to improve transit mode share to a new larger ballpark in the vicinity of Kenmore Square. The presentation of methodology includes three topics.

- A. Alternative development and screening**
- B. Standard units and assumptions**
- C. Discussion of factors affecting demand for transit to Red Sox games.**

4.3.A. Development and Screening of Alternatives

KKO employed a four step process to develop, evaluate and recommend alternative strategies to improve transit service to a new Kenmore area ballpark.

Step 1. Alternatives Development - KKO initially developed a broad list of possible strategies to maintain and increase the non-automotive mode share of persons coming to the Fenway Park area on game days. This list included twenty-nine strategies that had been identified by the Red Sox and other local constituencies, strategies used or proposed at other sports facilities in North America and Europe, and ideas known to have been considered by the MBTA and others in the past.

Strategies fell into three broad categories:

- 1. Institutional changes** – new “demand-side” incentives for fans to use the T or new “supply-side” mechanisms to improve the delivery of transit service with existing resources.
- 2. Operational changes** – “supply-side” and “demand-side” initiatives to deploy new game day transit services requiring additional operational resources from the MBTA.
- 3. Capital improvements** – “supply-side” investments to improve the quality of transit services that can be delivered on game days at Fenway Park.

Step 2. Initial Screening - KKO applied an initial screen to the list of twenty-nine alternatives. The initial screen

- Eliminated strategies which, even without detailed analysis, clearly were counterproductive, non-viable, or physically impractical in the Fenway area, and
- Eliminated strategies with scope far beyond the improvement of game day transportation to Fenway Park.

Ten strategies were eliminated during initial screening or early in the alternatives refinement.

Step 3. Alternatives Refinement and Evaluation – KKO developed further information required to evaluate the nineteen strategies that survived the initial screening phase. This information included:

- Total market served
- Market potential
- Costs (capital and operating) and revenues
- Unresolved details and other considerations

Total Market Served – KKO estimated the size of the total market that would be served by each strategy based on the number of stadium fans who travel by automobile but could make use of MBTA under the proposed strategy. KKO determined this figure to be the product of three factors:

- the new stadium's design crowd,
- the percentage of stadium fans who travel by automobile, and
- the percentage of game-related automobile trips in the particular highway corridor (or sub-corridor) effected by the modal strategy.

As described in Technical Memorandum #2, design crowd for baseball stadium transportation planning generally equals the tenth-largest attendance of the season. Using Red Sox' data for the 1999 season, KKO determined the design crowd of the current 33,871-seat facility to be 33,393. If the Red Sox can maintain the same high rate of attendance in the proposed new 44,130-seat facility, the new design crowd will be 43,507¹.

According to 1996 Red Sox' data, 68% of stadium fans travel to the ballpark by private automobile. Corridor distribution was also estimated from 1996 Red Sox' data:

Table 4.4		
1996 Estimated Automobile Trip Distribution by Highway Corridor		
Corridor	Sub-Corridor	Share
North (25%)	I-95 north / US route 1 north	10%
	I-93 north	15%
Northwest (12%)	Routes 2 & 2A north	9%
	Route 3 north	3%
West (28%)	I-90 west (Mass Pike)	27%
	Route 9 west	1%
South (30%)	Route 3 south	18%
	I-95 South	12%
Other (5%)	Local streets	5%
Total		100%

¹ The existing Fenway Park has 77% of the capacity of the proposed new facility.

Throughout this analysis, KKO used a design crowd of 43,507; an automobile share of 68%, and the corridor shares shown in Table 4.4 to estimate the total market served by a potential strategy. These estimates could be over- (or under-) stated to the extent that the Red Sox do not achieve the current high rate of attendance in the new facility and to the extent that conditions independent of MBTA service to the new facility change the automobile mode share.

Market Potential – KKO prepared preliminary strategy analyses regarding the total market share that each strategy could be reasonably expected to divert from automobile to transit. Where possible, KKO relied on the experiences of comparable strategies elsewhere to estimate market potential. Where appropriate, KKO calculated the market share change needed for a strategy to “break even”. “Break even” is defined as incremental operating revenues covering incremental operating costs.

Costs and Revenues – KKO estimated operating and capital costs for each alternative using appropriate costing methodologies and cost factors. KKO’s cost factors and other key parameters and assumptions used in refining the alternatives are documented in Appendix B.

Unresolved details and other considerations – Some considerations and impacts regarding alternatives could not be simply reduced to costs, revenues or ridership estimates. Where such considerations were found they are noted in the analysis.

Step 4. Recommendations - Based on the review of the information developed on the nineteen alternatives, KKO prioritized the list to indicate four categories of strategies.

Table 4-5 Recommendations by Type	
Category of Strategy	Strategies
Recommended for immediate action and follow up	4
Recommended for experimental implementation	9
Recommended for further evaluation	4
Not recommended	2
Total	19

4.3.B. Standard Units and Assumptions

Standard unit costs and unit capacities are used throughout the analyses of strategies. This information, detailed in Appendix B is generally based on recent MBTA experience and MBTA “rules-of-thumb”. Appendix B notes adjustments made to compensate for fuel cost increases,

potential fare increases, and site-specific differences between the Fenway Park area and the locations of comparable MBTA construction experiences.

4.3.C. Discussion of factors affecting demand for transit to Red Sox games

In developing and evaluating the alternatives, KKO was mindful of four factors that affect the demand for transit to major sporting events at downtown stadiums.

- Interdependence of strategies which increase demand for public transit and those which increase supply (i.e.: the MBTA's capabilities to meet that demand),
- Variations between pre-game and post-game situations and between weeknight games and weekend day games,
- The time it takes to play a ballgame, and
- Boston's relatively high existing transit modal share.

Each of these four factors is discussed in the paragraphs that follow.

Demand vs. supply - At first glance, it might seem that some strategies only impact the demand for transit service. These include strategies which provide fare incentives or promotional benefits to transit riders. Likewise, other strategies initially appear to impact supply but have no impact on demand. These include strategies which add commuter rail service, increase Green Line capacity, or spread the post-game peak over a longer period. Closer analysis, however, indicates that there are strong interrelationships between demand and supply strategies.

Almost every strategy aimed at increasing demand requires a complementary strategy that will increase the MBTA's ability to meet the new demand. With the possible exceptions of a few local bus routes, weekend pre-game Green Line service, and the existing game day commuter rail service to Yawkey, MBTA operations to and from Red Sox games are heavily patronized – sometimes to the point where additional ridership could significantly degrade operations. Accordingly, many demand-based strategies may require an offsetting supply-based strategy to avoid the counterproductive effect of making transit less attractive by increasing crowding and slowing operations.

Conversely, as indicated in Technical Memorandum #2, modal split is largely a function of the perceived level of inconvenience and discomfort involved in taking the various modes. Thus, a strategy aimed entirely at increasing transit will reduce the patron's perceived discomfort using crowded transit stations and/or vehicles *vis-à-vis* using a private car. This, in turn, may increase demand for transit. Accordingly, any successful supply-based strategy cannot be considered in a vacuum, but must be expected to have a corresponding impact of increased transit demand.

Pre-game/post game and weeknights/weekends -The amount and nature of transit supply and demand varies both between pre-game and post-game situations and between weeknight games and weekend games². Pre-game/post-game and weeknight/weekend variations in transit supply and demand are discussed below relative to the potential effectiveness and practicality of the various modal strategies.

Pre-game transit demand appears to be higher than post-game transit demand. CTPS post-game subway counts are 16% lower than pre-game. Post game week-night commuter rail conductors' counts are 4% lower than pre-game. Post-game use of the Red Sox' Ruggles shuttle is 40% less than pre-game.

Pre-game transit demand appears to be less concentrated than post-game transit demand. Pre-game arrivals at Fenway Park appear to be spread over a greater than two-hour period: 50% arrive during the hour before the first pitch, 25% arrive during the previous hour, 25% arrive either more than two hours early or after the start of the game.³ Conversely, Fenway Park clears within minutes after the end of a game⁴. The vast majority of fans apparently proceed directly to their post-game transportation. Rather than being spread out over more than two hours, the post-game peak at Kenmore station is often over in less than thirty minutes.

The spike in demand after games is perhaps the most critical element of any strategy to increase the MBTA's share of the modal split at the current Fenway Park and to at least maintain the current modal split in the new larger facility. The current peak post-game eastbound crowds at Kenmore Station are so large that any strategy's potential for success may be limited unless it is accompanied by strategies that reduce these crowds by either:

- increasing the rate that the MBTA can move people through Kenmore Station, or
- spreading the peak demand over a longer time interval, or
- diverting riders away from Kenmore Station to other MBTA assets.

² As documented in Technical Memorandum #3, 88% of Red Sox games are weeknight games beginning at 7:05 PM or weekend/holiday day games starting at 1:05 PM. The remaining 12% (ten games) are split among three early-season weekday games played in the afternoon, four week-night games starting at 6:05 PM (rather than 7:05 PM), the Patriots' day game (11:00 am), and two weekend night games. These ten games vary in their applicability to conclusions drawn for the remaining 88%.

³ Red Sox' *Fenway Area Proposed Transportation Improvements* (August, 1998; updated November, 1999) - Summarized in Technical Memorandum #3.

⁴ On occasion, when there is a lopsided score, the ballpark begins to empty a few innings before the end of the game, and the post-game demand for transit is less concentrated. On rarer occasions, such as the winning of a key late-season game, post-game street celebration tends to spread the peak transit demand slightly.

Weekend games differ from weeknight games in the MBTA's availability of resources to meet game day-related demand:

- On weekends, and after weeknight games, the MBTA has idle buses, Green Line vehicles, and commuter rail trainsets which, in theory, can be used to augment service and meet game-related demand.
- Conversely, pre-game weeknight demand for game-related service coincides with the end of the MBTA's normal evening rush hour⁵. The MBTA's vehicles are either fully utilized or are not properly positioned to run special service to handle the game-related demand⁶.
- Predominant outbound commuter rail service on the Northeast Corridor to Providence precludes stopping inbound afternoon trains at Ruggles to connect with the Red Sox' Ruggles shuttle bus to a weeknight game.⁷
- Outbound rush hour Framingham/Worcester trains are already heavily loaded and unable to also accommodate a large number of fans wishing to transfer from inbound trains at South Station or Back Bay to get to a weeknight game.

The variation of potential demand between weeknight and weekend games is not fully known. From the available data, KKO could not determine from available data the variation in fans' travel patterns between weeknight and weekend games. For example, more family groups might travel together in both directions on weekends than on weeknights. Conversely, on weeknights, more people might arrive separately at the game, meet, and then travel home together.

How long will it take to play the ball game? - According to Red Sox statistics, actual lengths of regular season games in 1999 varied from 2:14 hours to 3:52 hours⁸. A wide variability in the

⁵ This situation also exists with post-game demand for the three weekday afternoon games. It is even more severe prior to the four early (6:05 PM) weeknight games.

⁶ At the end of the evening peak, Green Line cars are stored in the suburbs. They are not in a position to supplement service from downtown to Kenmore during the 6 PM to 7 PM time frame. Only one of the 32 south side commuter rail trainsets is out of service in the suburbs (in Kingston at 5:30 PM) sufficiently early to be available to carry stadium fans on a pre-game train to a weeknight game.

⁷ Track 2 (the normal inbound track at Ruggles) has no station platform. Inbound trains stopping at Ruggles must be diverted to outbound tracks 1 or 3 from Forest Hills a point beyond Back Bay. Because of heavy outbound traffic, no such diversions are made between 2:41 and 7:49 PM.

⁸ If rain delays and delayed starts are also considered, 1999 games ended as late as 4:10 hours after their published start time. The team's data indicates that the Red Sox did not play any extra-inning games at home in 1999. Extra-inning games could easily have run longer than 4:10 hours.

ending time of games results. This shifts the timing of peak post-game demand for MBTA services. Weeknight games ended as early as 9:19 PM⁹ and as late as 11:15 PM. Weekend and holiday day games ended as early as 3:24 PM¹⁰ and as late as 4:39 PM¹¹. The resulting impact on subway riders is minimal, but the impact on potential commuter rail riders is substantial:

- No weeknight game ran so late that Green Line passengers could not catch the final train of the operating day to Riverside, Cleveland Circle, Boston College, or Lechmere or transfer to the final Red, Orange, or Blue Line train to any destination on those lines.
- Three weekend (1:05 PM) games ran too late to allow fans to catch the scheduled commuter rail service from Yawkey to Framingham.
- Eight weekend (1:05 PM) games ran too late to allow fans to catch the commuter rail service from Yawkey to Attleboro.
- Numerous weeknight games ran so late so as to preclude reliable connections at Ruggles and North Station to the last train on the various north and south side commuter rail lines.

Table 4-6 Potential Missed Commuter Rail Connections After Weeknight Games 1999 Red Sox Season		
Line	Connection	Number of games ending too late to let fans catch the train
Rockport, Fitchburg	North Station	2
Attleboro (12:07 am train)	Ruggles	3
Lowell, Haverhill	North Station	4
Framingham	Yawkey ¹²	4
Newburyport	North Station	6
Stoughton	Ruggles	18
Worcester	Yawkey ¹³	27
Needham	Ruggles	38
Attleboro (10:33 PM train)	Ruggles	43
Franklin	Ruggles	45

Sources: Boston Red Sox game statistics, MBTA timetables

⁹ 8:56 PM if 6:05 PM games are considered in addition to 7:05 PM games.

¹⁰ Not including the Patriots Day game which ended at 1:34 PM.

¹¹ Not including 4:05 PM Saturday games which ran as late as 7:23 PM.

¹² MBTA's new 2000 policy of holding train 537 as late as 11:40 PM for late games would have protected the fans at all of these games.

¹³ MBTA's new 2000 policy of holding train 585 as late as 10:45 PM for late games would have protected the fans at eighteen of these twenty-seven games.

Boston's relatively high existing transit modal share - Boston and the Red Sox already achieve an enviable transit modal share. Only New York's Yankee Stadium and Shea Stadium and Toronto's Skydome experience a higher transit share.

Due to this comparatively high transit modal share, relatively simple strategies, which might work well at stadiums where there is very low transit ridership, may have reduced effectiveness. The easily divertable share of the fan travel market has already been captured. Rather, Boston will have to rely on more creative and innovative strategies to further increase transit's share of the fan ridership. However, the New York and Toronto experiences do indicate that Boston may have opportunities to increase the transit share of stadium fans.

4.4. Institutional Strategies to Improve Service Performance

Institutional strategies to improve the performance of MBTA game day services to Fenway Park involve enhanced operating management, fare initiatives, promotions, priority transit vehicle access, and demand management. Institutional strategies do not require substantial changes in operations or major investments in facilities or vehicles. Many institutional strategies share the following characteristics:

- Cooperative effort of other entities in addition to the MBTA
- Relatively inexpensive to implement

Some institutional strategies can be implemented experimentally.

Current MBTA game day institutional strategies used by the MBTA focus on enhanced operating management and promotion of available services.

- **Coordination:** The Operations Control Center duty supervisor at 45 High Street monitors pre-game readiness and game progress, maintains ongoing contact with Red Sox management, and provides coordination with the subway and Amtrak dispatchers.
- **Supervision:** The on-duty Green, Orange, and Red Line supervisors, six extra Green Line officials, and supervisors from Bus Operations are strategically located at or near the Kenmore, Fenway, Blandford, and Ruggles stations.
- **Expedited revenue collection:** Extra personnel are stationed at Kenmore and Riverside, passengers are urged to purchase return tokens on the way to the game.
- **Police:** Twelve to fourteen MBTA police officers are positioned at strategic locations.
- **Promotion:** Red Sox in-stadium and general broadcast promotion of MBTA services is fairly extensive.

KKO believes that the MBTA has fully developed enhanced operational management as a game day strategy. With the possible exceptions of on-going monitoring and minor fine-tuning, KKO finds little that the MBTA could to improve its management of current game day operations.

However, KKO identified and evaluated seven additional institutional strategies that would both increase the MBTA's modal share of stadium fans and enhance the MBTA's ability to meet the increased demand:

- A. Bundled ticketing of transit with game tickets
- B. Priority street access to/from Fenway Park for buses
- C. Post-game events to level peak transit demand
- D. Local measures to level post-game peak demand
- E. Red Sox special pre-game events at Riverside
- F. Game day signage near Riverside
- G. Subsidized transit for employees and concessionaires

4.4.A. Bundled ticketing of transit with game tickets

Bundling pre-paid transit tickets with game tickets may represent the most cost-effective option available to the Red Sox and MBTA to divert game fans from automobile to transit. Over 3,000 fans could be diverted from nearly 1,000 automobiles with zero net cost to either the team or the Authority.

Under this strategy, the Red Sox would print and distribute MBTA transit tickets with every advance game ticket sold (including season tickets and tickets by mail). The transit tickets would identify the particular game and be valid for travel to and from that game only. Tickets would be good for a ride on the subway or the basic bus system and for a discount on other higher priced MBTA services such as commuter rail. The MBTA would accept the tickets as fares and would then present tickets actually used to the Red Sox for reimbursement. Red Sox would include the transit ticket cost as a hidden "bundled" cost in their ticket pricing. The bundled cost would be based on the estimated percentage of tickets issued that actually will be used and presented for reimbursement.¹⁴

All Red Sox fans would financially contribute to game day transit service whether or not they used the T. Stadium fans using the MBTA would see the following discounts:

¹⁴ Alternatively the MBTA and Red Sox could agree upon a fixed reimbursement for each game. The MBTA would carry all Red Sox fans that present the bundled tickets for service to and from the game.

Table 4-7		
Value of Bundled Tickets to Fans using Bundled Tickets		
Service Used	Round trip without bundled ticket	Round trip with bundled ticket
Local bus routes	\$1.50	"free"
Most subway & Green Line	\$2.00	"free"
Riverside (beyond Reservoir)	\$3.50	\$1.50
Quincy	\$3.00	\$1.00
Braintree	\$4.00	\$2.00
Commuter rail via Yawkey	Varies	\$2.00 discount
Other commuter rail	Varies	\$2.00 discount and/or free subway connection

This table reflects a \$2.00 cap on the value of a bundled round trip ticket; a higher cap could make the strategy more attractive for use on longer distance services.

Similar bundling of transit with event tickets is used elsewhere. For instance, the Munich (Germany) Public Transportation Company (MVV) has "tariff cooperation contracts" with the football club (FC Bayern München), theaters, trade fairs, and others. Transportation systems in major US theme parks are "free". Numerous events and facilities offer "free" courtesy transportation. In Boston, the Red Sox subsidize the "free" Ruggles shuttle.

Total market served - The market served includes nearly all of the 29,600 stadium fans traveling to the game via automobile¹⁵.

Market potential - Market research in Munich indicates that tariff cooperation contracts increase event-related use of public transit by 30%. Without bundled tickets, the Red Sox project game day MBTA ridership to the larger stadium at 10,000. Bundled tickets would increase this to over 13,000 stadium fans (26,000 one-way trips) per game. Bundled tickets may increase the MBTA's share from 23% to 30% of traveling stadium fans (a 30% increase).

Table 4-8	
Bundled Ticketing Market Potential	
Total transit users without bundling	10,007
Total transit users with bundling	13,009
Total increment due to bundling	3,002
Percent MBTA riders without bundling	23%
Percent MBTA riders after bundling	30%

One-way MBTA trips increase from 20,000 to 26,000 per game with bundled tickets.

¹⁵ As described in Section 3 of this technical memorandum, all market analyses are based on a "design crowd" in the new stadium. In most cases, the market at the current Fenway Park would be approximately 77% of the market at the new facility.

Costs and revenues - The bundled ticket strategy would increase MBTA income by approximately \$11,500 per game (\$23,650 in redeemed tickets minus \$12,150 in reduced farebox receipts). This represents a revenue increase of almost \$1 million per season. The MBTA would see increased administrative costs of \$300 per game for processing the ticket stubs and managing the reimbursement process. In return for this new income, MBTA would be obligated to provide capacity to handle approximately 3,000 new patrons (6,000 one-way trips) to and from the new ballpark.

Costs would also be incurred to design and print marketing information to help teach stadium fans how to use the bundled tickets and the MBTA's transit system.

Table 4-9	
Bundled Tickets Redemption Costs	
MBTA clerical labor hours per game	8
Labor rate	\$22.76
Overhead	65%
MBTA cost per game (fully burdened)	\$300

Bundled ticketing can be designed as an attractive proposition for both the MBTA and the Red Sox. MBTA would be compensated for the additional riders that it carries. This compensation would approach \$24,000 per "design crowd" game of 43,500 stadium fans. This translates to an upper limit of \$1.9 million for the season if every game achieves design crowd attendance.

The Red Sox finance this strategy by building approximately 54 cents into the cost of each game ticket sold so that they "break even". However, it should be noted that the Red Sox also benefit from an unquantified increased marketability of their game tickets and from substantial neighborhood good will.

Table 4-10
Bundled Ticketing Detailed Financial Analysis

Route distribution of MBTA ridership using bundled tickets:	Number of round trip users	Value per bundled ticket (round trip)	Total value of bundled tickets	Changed farebox income
Subway (includes commuter rail to subway)	7,205	\$2.00	\$14,410	(\$10,807)
Green Line Surface (Commonwealth and Beacon)	1,801	\$2.00	\$3,602	(\$2,702)
Riverside	1,801	\$2.00	\$3,602	\$0
Bus	720	\$1.50	\$1,081	(\$811)
Rail to/from Yawkey	480	\$2.00	\$961	\$2,161
Total per game			\$23,656	(\$12,158)
Game tickets sold (design crowd)	43,507			
Bundled ticket cost per game ticket sold	\$0.54			
Approximate upper cost limit per season	\$1,916,115			

The following assumptions are used in Table 4-10:

- *MBTA users (design crowd - prior to bundling): 10,007*
- *Percent current users using monthly pass: 10%*
- *MBTA riders who will continue to use monthly pass: 1,001*
- *MBTA riders changing from cash to bundled ticket: 9,006*
- *Diverted users due to bundling (all will use ticket): 3,002*
- *Total users of bundled tickets: 12,008*

The bundled ticketing strategy cannot be considered in a vacuum. Other supply-oriented modal split strategies, if also implemented, will likely interrelate with bundled ticketing, increase the number of passengers diverted, and require a change in the “hidden” 54 cent charge per game ticket needed to keep bundled ticketing a zero-sum situation for the Red Sox.

Unresolved details and other considerations

- Willingness of Red Sox to participate
- Design of tickets (anti-fraud and data tracking considerations)
- Method for collecting tickets
- Method for accounting and redemption of tickets
- Tracking needed to monitor and fine-tune the strategy once it is implemented
- Whether and how to allow transfer from commuter rail to subway, from bus to subway, and from bus to bus
- Verification of assumptions (see discussion that follows),
- Transit use information for stadium fans who are not regular MBTA commuters (see discussion that follows).

Verification of assumptions: The market potential and financial analysis relies on assumptions which should be verified.

- Only 10% of the Red Sox fans using the MBTA have and use monthly transit passes rather than the bundled tickets¹⁶,
- Modal split among stadium fans will tend to remain constant with the new stadium¹⁷,
- Each bundled ticket is good for \$1.00 in MBTA services on the day of the game. Each stadium fan with an advance ticket is issued to two bundled transit tickets.
- The following distribution of game-related ridership among MBTA services:
 - 60% Green Line to/from the east
 - 15% Green Line on Commonwealth Ave and Beacon St Lines
 - 15% Green Line on the Riverside Line
 - 6% MBTA Bus
 - 4% Commuter rail at Yawkey

Transit User Information: A key tool to full implementation of the bundled ticket strategy is the distribution of MBTA information so that stadium fans who are not regular MBTA commuters will know how to use transit to travel to the game.

The Red Sox should distribute a transit information flyer with every advance admission ticket and bundled transit ticket sold. Ideally, the flyers would be route-specific and distributed based on the stadium fan's zip-code. The flyers (which would be prepared by MBTA) would contain details on all transit options to reach the ballpark from the fan's home including:

- Station parking
- Route numbers
- Schedules
- How to make connections
- Proximity of nearby stations to Fenway Park
- How to avoid the post-game peak crowd
- Details of safeguards in effect to protect patrons who risk missing "last" buses or trains when games run late¹⁸.

The flyers target stadium fans who are not familiar with the MBTA or how to use it.

¹⁶ This is lower than the percentage of MBTA commuters who use monthly passes because a substantial number of non-MBTA commuters attend Red Sox games.

¹⁷ Although the Red Sox' *Fenway Area Proposed Transit Improvements* report uses (without explanation) the same modal split for the new facility as for the existing ballpark, KKO has no independent information to confirm or deny this assumption.

¹⁸ Such as provisions to hold Framingham trains 587 and 535 when games run late.

Recommendation - KKO recommends that bundled ticketing be considered for implementation on an experimental basis during the next baseball season. Bundled ticketing appears to have the potential for diverting over 3,000 fans per game at the new ballpark from automobile to transit without major costs or risks to either the Red Sox or the MBTA. Bundled ticketing also appears to be a substantial opportunity for the Red Sox to generate neighborhood good will and to market tickets to the new stadium.

4.4.B. Priority street access to/from Fenway Park for buses

The MBTA can work with the City of Boston and the Red Sox to ensure the quality of bus and pedestrian access to the new ballpark through roadway design and priority street access.

Ideally, the shortest distance from a vehicle to the ballpark gates should be from a bus stop, and the first vehicle that a fan sees when leaving the game should be a bus that is positioned to depart via priority roadways. Currently, the MBTA copes with congested game day streets and sidewalks around Fenway Park by diverting bus routes away from the streets adjacent to the ballpark.

This strategy, lead by the City, would mandate that Red Sox stadium planners, traffic planners, and the developers of new parking facilities work in conjunction with the MBTA and interested private bus carriers to ensure that:

- Roadways will provide buses with good access to the ballpark,
- Buses (MBTA and private) will have adequate priority queuing for the post-game peak, and
- Pedestrian access between the ballpark and MBTA stations will be improved and avoid conflicts with vehicular traffic (especially buses).

While an MBTA veto power over the planning process may be unrealistic, the Authority should seek a strong participation in facility access planning and the reconfiguration and game day use of adjacent roadways.¹⁹

Rather than diverting the #8, #60, and #65 buses away from Brookline Avenue on game days²⁰, the MBTA should be able to divert extra buses to that roadway and have them stop directly at the gate of the ballpark.

While this is a very simple concept, it is not at all easy to fully implement. The location and density of adjacent land uses, the need for continued access to nearby parking facilities, and a

¹⁹ This concept may also require the participation of the Metropolitan District Commission which could grant MBTA buses game day access to nearby parkways that are otherwise restricted to commercial vehicles.

²⁰ Brookline Avenue, a key MBTA corridor, runs along the edges of both the existing and proposed Fenway Parks.

variety of neighborhood issues all compete for the assets needed to optimize bus access. However, except for a brief reference to charter bus parking, KKO found no indication in the Red Sox plans that gives meaningful consideration to bus access.

Total market served - The MBTA's principal affected market is the neighborhood served by the existing buses serving the Fenway/Kenmore area²¹. Some of these are circumferential routes serving areas which would otherwise be reached from the Fenway Park area by a downtown subway transfer including Cambridge, Dorchester, Jamaica Plain, Roslindale, and Roxbury. Others serve relatively dense neighborhoods immediately west of Fenway Park including Allston, Brighton, Brookline, Newton, and Watertown.

Market potential - Although the market potential appears substantial, KKO has no available data to predict the diversion of mode share resulting from better MBTA bus access to Fenway Park.

Costs and revenues - At this stage in the planning process, cost to the MBTA, to the Red Sox, and to the City for this strategy appear to be little more than the costs of providing input and review to the planning process. Conversely, if plans are further advanced without bus-oriented input, the costs for implementation of changes could become substantial. Capital costs for the MBTA, the City, and the Red Sox appear be limited to providing bus shelters, signage, and traffic control barriers. MBTA game day operating costs may actually decrease.

Unresolved details and other considerations

- Securing commitment to a strong bus-oriented input in the planning process
- Accomodation of competing interests for game day access to parking garages and other neighborhood facilities
- Location and design of any priority bus routes and pedestrian accessways.

Recommendation - KKO recommends that MBTA immediately initiate a concentrated effort with the City and the Red Sox to maximize MBTA²² participation in the neighborhood traffic planning process.

If the planning process continues without active MBTA participation on bus access issues, opportunities to incorporate bus access into the Red Sox' plans, to induce the city to provide priority routes, and to divert automobiles from the most critical bus and pedestrian pathways will be reduced.

4.4.C. Post-game events to flatten peak transit demand

Any strategy which delays the arrival of some fans at Kenmore Station after the end of the game levels a very sharp peak in demand. This, in effect, increases the Green Line capacity at no

²¹ As documented in technical memorandum #3, these include routes 8, 47, 55, 57, 60, 65, and CT-2.

²² Planning and Bus Operations

incremental cost. In fact, it may allow the first eastbound post-game run-as-directed trains to turn at Park Street and arrive back at Kenmore in time to pick up outbound fans. More importantly it spreads the eastbound peak over more regularly scheduled trains which have unused capacity.

Under this strategy, the Red Sox would use post-game in-the-park events to entice a portion of the stadium fans to delay their departure from the park by a few minutes. Events could include seat-number-based raffles of souvenirs, fan-appreciation appearances by players, a brief organ concert, or other short-duration diversions - even the singing of a theme song.

Total market served – The total market served includes all 11,700 stadium fans using the Green Line plus those fans who currently avoid using the MBTA for games because of the post-game crowding at Kenmore and/or the crowded conditions on the Green Line.

Market potential - This strategy is aimed at increasing the effective supply of transit service at Kenmore when the passengers want to travel. Some increased ridership should be realized as the peak crowd size decreases and use of the less-crowded station becomes more attractive.

Costs and revenues

- **MBTA:** no costs, small positive revenue impact possible
- **Red Sox:** unknown costs associated with the staging event and with keeping the park open for a few more minutes

Unresolved details and other considerations

- Willingness of Red Sox to participate
- Types of events

Recommendation - KKO recommends that the Red Sox and the MBTA pursue an experimental implementation of this strategy at a limited number of games in 2001 with appropriate monitoring of crowd flow to determine its effectiveness.

4.4.D. Local measures to flatten post-game peak demand

Like the previous strategy, this strategy can increase the MBTA's effective capacity at the most critical game day time and place: immediately after the game at the Kenmore Station. Any situation which delays the arrival of some fans at Kenmore Station at the end of the game helps level a very sharp demand peak and, in effect, increases the Green Line's capacity at no incremental cost.

Under this strategy, the Red Sox and the City would allow and encourage a limited amount of diversions (such as street entertainers and/or souvenir vendors) after the game on the streets between the ballpark and Kenmore station.

Total market served – The target market includes the 11,700 stadium fans using the Green Line plus those stadium fans who currently avoid the Green Line because of the post-game crowds at Kenmore and the crowded conditions on the Green Line.

Market potential - This is a supply-based strategy, but it should have a secondary effect of increasing transit demand among those who avoid crowded conditions on the subway.

Costs and revenues

- **MBTA:** no costs, small positive revenue impact possible
- **Red Sox:** little, if any, costs
- **City of Boston:** little, if any, costs

Unresolved details and other considerations

- Determining how, why, and to what extent such potential diversions are now discouraged
- Determining how to control such diversions so that they do not create security issues
- Willingness of the City and the Red Sox to participate

Recommendation - The MBTA, the Red Sox and the City of Boston should further investigate this strategy to determine if and how it can be implemented.²³

4.4.E. Red Sox special pre-game events at Riverside

The MBTA would allow, encourage, and provide space for the Red Sox to conduct pre-game promotional activities at the Green Line's Riverside station. The range of potential activities is quite wide: autograph and/or photo sessions with former Red Sox stars, souvenir give-aways, contests, and other activities devised by Red Sox promotional staff²⁴.

The aim would be to divert existing Red Sox fans to the Green Line and to attract new fans to the ballgame on days when Fenway Park is not sold out. The Red Sox would promote these events, as they do others, on radio and TV broadcasts.

The activities need not necessarily take place before every game, but can be scheduled by mutual consent to meet the promotional goals of both the team and the Authority or with the available capacity of the Riverside parking lot.

This strategy complements, and can be coordinated with, other strategies including Institutional strategy F (Game Day Signage) and Operating Strategy F (Express pre-game Green Line trains between Riverside and Fenway/Kenmore).

²³ The proposed new ballpark would, because of its location, partially implement this strategy merely by forcing fans to walk a longer distance at varying rates to the subway station at Kenmore.

²⁴ Subject, of course, to space and safety constraints imposed by the MBTA and to the MBTA's community good taste standards.

If successful, this strategy might lend itself to other transit stations on the rapid transit network.

Total market served - The principal market is the 8,300 stadium fans traveling by automobile from the west via the Mass Pike and Route 9. This is the second heaviest volume corridor for Red Sox fans.

Market potential - No data are available to suggest the number of fans who would be drawn by such promotions or whether, once drawn to the Green Line, these fans would continue to use the service to travel to subsequent games. However, even a 5% diversion would translate into over 400 fans and nearly \$1,500 in new game day revenue to the MBTA on a route where capacity is available to handle the extra ridership. In addition, this strategy could generate new stadium fans providing additional revenue for both the MBTA and the Red Sox.

Costs and revenues - MBTA's cost for this strategy are close to zero: merely the cost of making the space and some electric power available and the appropriate stationing of security staff. Red Sox costs are also relatively small - perhaps only the diversion of a very small portion of their promotional budget.

Unresolved details and other considerations

- Red Sox' willingness to participate
- Capacity and site constraints at Riverside
- Security and supervision details
- Nature and number of promotions
- Promotion dates

Recommendation - KKO recommends that the MBTA explore this strategy with the Red Sox. A limited number of these promotions could be held on an experimental basis during the 2001 season. The strategy could be expanded to other stations in subsequent years if the initial experiment is successful.

4.4.F. Game day signage near Riverside

The Massachusetts Highway Department and the Massachusetts Turnpike Authority would use available portable programmable information signs to direct inbound game day traffic to Green Line stations on the Riverside line.

Total market served - The principal market is the 8,300 stadium fans traveling by automobile from the west via the Mass Pike and Route 9.

Market potential - No data are available to suggest the number of fans who would be drawn by such signs or whether, once drawn to the Green Line, these fans would continue to use the service to travel to subsequent games. However, even a 5% diversion would translate into over 400 fans

and nearly \$1,500 in new game day revenue for the MBTA on a route where capacity is generally available to handle the extra ridership.

If successful, this strategy could be expanded to other key transit stations.

Costs and revenues

- No costs to the MBTA, the MHD, or the MTA other than coordination of the placement of the signs

Unresolved details and other considerations

- Willingness of the MHD and the MTA to participate

Recommendation - KKO recommends that the MBTA and the MHD coordinate the experimental placement of signs aimed at the Riverside station throughout the 2001 season. The success of the effort should be monitored (perhaps by on-site polling at Riverside).

4.4.G. Subsidized transit for employees and concessionaires

The Red Sox and the Red Sox' concessionaires would issue transit tickets or passes to all employees and urge the employees' use of the MBTA on game days. This could be done in conjunction with bundled ticketing or by employer purchase of ordinary MBTA monthly passes.

Total market served - KKO has no firm data on the number of employees involved, but estimates the game day employee population in the service area to be in the range of one to two thousand game day workers.

Market potential - KKO has no firm data on the number of employees currently using the MBTA, but estimates the number of divertable employees to be in the range of 300 to 700.

Costs and revenues

- \$600 to \$1,400 per game using tickets; \$30,000 to \$60,000 per month using MBTA passes.
- Costs are paid by Red Sox and by concessionaires.
- No cost to MBTA. Since the departure times of many employees from the ballpark do not exactly coincide with the peak post-game rush of fans, little or no increased peak capacity is required.

Unresolved details and other considerations

- Red Sox' willingness to implement this strategy

Recommendation - KKO recommends that MBTA urge the Red Sox to implement subsidized transit for employees and concessionaires as a low-cost employee benefit that will also enhance neighborhood good will.

4.5. Operational Strategies to Improve Transit Service to Fenway Park

Operational strategies to improve the performance of MBTA game day services to Fenway Park involve changing the number, configuration, route, stopping pattern, or schedule of bus, rail transit, or commuter rail services on existing MBTA routes. They may involve “hiring” overtime crews. With the exception of lengthening the existing platform at Yawkey station none of the operating strategies require substantial capital costs:

- A. Kingston commuter rail service
- B. Providence/Attleboro commuter rail service
- C. Pre-game commuter rail from South Station to Yawkey
- D. Longer Green Line trains dedicated to post-game service
- E. Improved post-game service to North Station
- F. Express trains from Riverside to Kenmore
- G. Coordinated commuter rail at Ruggles
- H. Express bus service from Fenway Park to Cambridge Red Line stations

4.5.A. Kingston commuter rail service

This strategy eliminates two factors which work against marketing the existing game day service from the south to Yawkey station:

- Post-game service is not timed with the actual end of the game
- There are delays associated with a station stop and change in train direction at South Station

It makes use of the only trainset currently available for pre-game service on weeknights. It is targeted at the densest corridor used by stadium fans who drive to the games.

An available commuter rail train set²⁵ at Kingston would be used to run dedicated revenue trips to and from Yawkey station for all games except the seven non-holiday weekday games that start before 7:05 PM²⁶. The train would stop at all Kingston line stations including Braintree and Quincy. In South Boston, the train would proceed directly from the Old Colony tracks to the Framingham/Worcester line via the “wye” track over the Fort Point Channel. The train would not run via South Station and would not change direction *en route*. The return train would depart from Yawkey a few minutes after the game ends.

²⁵ This trainset becomes available on weeknights at 5:10 PM with the arrival of train 043.

²⁶ Four weeknight games begin at 6:05 PM - too early for the available trainset to reach Fenway Park. Three weekday games start at 1:05 PM and could run sufficiently late that the post-game trainset would be needed for rush-hour service.

Regular commuter rail fares would be charged. Monthly commuter rail passes and twelve-ride tickets would be honored²⁷.

During an experimental period, the Yawkey station location could be used with minor lengthening of the existing low platform. Arrangements would need to be made with CSX Corporation for the Kingston train to layover during the game on track 1 adjacent to the Allston freight yards.

If the experimental trial is successful, service in subsequent years could be to a turnback and storage facility on the old Highland Branch. With the new facility, layover at Allston would no longer be necessary.

Market potential – The target market consists of the 5,400 stadium fans who travel by automobile via the Route 3 (south) subcorridor plus an undetermined number of additional fans who can use the Quincy and Braintree stations. The south corridor is the densest highway corridor serving Fenway Park.

Estimate of market potential - No other MBTA service is sufficiently similar to enable accurate prediction of ridership.²⁸

Costs and revenues

- Running the dedicated Kingston train to and from all games except the seven non-holiday weekday games that start before 7:05 PM would cost approximately \$117,000 for the season.
- If the service captures 4.5% of the available market, incremental fares would be sufficient to offset costs. Revenue forecasts conservatively assume that the average stadium fan using this service will pay 79% of the \$4.00 Zone 5 fare.²⁹

²⁷ Honoring monthly passes and twelve-ride tickets is important to market this strategy. This differs from the MBTA practice for trains to Foxborough stadium. Unlike Patriots trains, the Kingston service would run entirely on regular MBTA commuter rail routes and mostly on ordinary workdays. Part of the anticipated ridership is regular (or potential) MBTA rail commuters.

²⁸ Reportedly, a dedicated service from Franklin to Yawkey was tried over a decade ago, but was discontinued due to poor ridership performance. Unlike the Kingston corridor, the Franklin corridor's share of Red Sox stadium fans is relatively small and the routing from Franklin to Fenway was not time competitive with the automobile.

²⁹ This zone 5 assumption is based on a large segment of the Red Sox ridership boarding at Braintree. (54% of Kingston Line daily riders board at zone 6, 7, and 8 stations.) The 79% multiplier reflects the mix of full fare, twelve-ride, half-fare and monthly tickets.

Table 4-11 Kingston Cost Analysis			
	Units	Unit cost	Cost
Crew duty hours per trip	8		
Miles per round trip	68		
Engineer wages (overtime)	8	\$39.98	\$320
Conductor wages (overtime)	8	\$33.50	\$268
Assistant Conductor wages (overtime)	16	\$27.20	\$435
Overhead			16.43%
Overtime for car cleaner/maintainer at Kingston	1	\$20.00	\$30
Overtime overhead			16.43%
Crew cost per game			\$1,2265
Fuel costs per train mile	68	\$2.50	\$170
Incremental maintenance per train mile	68	\$2.78	\$189
Total train mile charges			\$359
Total game day charges			\$1,585
Weekend and holiday games served	28	\$1,585	\$44,373
7:05 PM weeknight games served	46	\$1,585	\$72,899
Total trains and cost per season	74		\$117,272
Round trip riders per game needed to meet costs	250		

The train's break-even ridership is 4.5 of the potential market.

Unresolved details and other considerations

- Agreement with CSX for layover at Allston
- Close coordination of dispatching of post-game trains with the CSX dispatcher and with the schedules of Framingham 585 and 537
- Scheduling weeknight inbound train between outbound trains on the Old Colony's single track territory
- Restoration schedule for the "wye" track at the Fort Point Channel (now temporarily out of service due to Central Artery/Tunnel construction)

An optional aspect of the experimental dedicated train service would be approximately \$24,000 in capital improvements to lengthen the station platform at the existing Yawkey station.

Recommendation - KKO recommends the MBTA explore this strategy as a well-publicized experimental trial. This is the only route where a trainset is available to provide dedicated service both to and from weeknight games. This rail route serves the highest-density stadium fan automobile approach corridor identified by the Red Sox.

4.5.B. Providence/Attleboro commuter rail

Like the proposed Kingston service, this strategy avoids post-game service not timed with the actual end of the game and the delays associated with a station stop and change in train direction at South Station. Unlike the Kingston service, this strategy does not provide a dedicated service to the ballpark prior to weeknight games³⁰.

An available commuter rail trainset at East Junction would run dedicated revenue trips to and from Yawkey station for all weekend and holiday games. An available trainset at Boston would provide post-game service to all weeknight games that start at 7:05 PM. Weeknight stadium fans would take regularly-scheduled trains to Boston³¹.

The train would stop at all Attleboro/Providence line stations except those east of Readville. The train would run via the Dorchester Branch between Readville and South Boston and would proceed directly from the Dorchester Branch to the Framingham/Worcester line via the "wye" track over the Fort Point Channel. The train would not run via South Station and would not change direction *en route*. On weeknights, the post-game train would return empty from Providence to Boston.

Regular commuter rail fares would be charged. Monthly commuter rail passes and twelve-ride tickets would be honored.

For an experimental trial of service, the existing Yawkey station location could be used. Arrangements with CSX for the train to layover during the game on track 1 adjacent to the Allston freight yards would be required.

Total market served – The market for this service is considerably thinner than the market for the Kingston service. It primarily includes the 3,600 stadium fans who travel by automobile via the Route 95 (south) subcorridor.

Market potential - No other MBTA service is sufficiently similar to enable accurate prediction of ridership at this time.³² Game day automobile ridership on the route 95 (south) subcorridor is two thirds as dense as that on the Route 3 (south) subcorridor.

Costs and revenues - This strategy would cost approximately \$107,000 per season (\$46,000 for the weekend service and \$61,000 for the weeknight service). If the weekend service captures 8.1% of the available market, incremental fares are sufficient to offset costs. Revenue estimates are based on the conservative assumption that the average stadium fan using this service will pay

³⁰ No trainset is available pre-game on weeknights.

³¹ Train from Providence at 6:22 p.m. Train from Providence arriving Back Bay at 6:51 p.m.

³² The current weekend Attleboro service to Yawkey is not comparable because it is not timed to the end of the game and because it involves a substantial delay at South Station.

79% of the Zone 4 fare of \$3.50. Weeknight service would need to capture 6.6% of the available market to offset incremental operating costs.

Table 4-12 Providence Train Cost Analysis (Weekends)			
	Units	Unit cost	Cost
Crew duty hours per trip	8		
Miles per round trip	88		
Engineer wages (overtime)	8	\$39.98	\$320
Conductor wages (overtime)	8	\$33.50	\$268
Assistant Conductor wages (overtime)	16	\$27.20	\$435
Overhead			16.43%
Crew cost per game			\$1,191
Fuel costs	88	\$2.50	\$220
Incremental maintenance	88	\$2.50	\$220
Total vehicle mile charges			\$440
Total game day charges			\$1,631
Total weekend or holiday trains and cost per season	28		\$45,666
Round trip riders per game needed to meet costs	294		

The weekend train's break-even ridership is 8.1% of the available market.

Table 4-13 Providence Train Cost Analysis (one-way weeknights)			
	Units	Unit cost	Cost
Crew duty hours per trip	6		
Miles per round trip	88		
Engineer wages (overtime)	6	\$26.65	\$240
Conductor wages (overtime)	6	\$22.33	\$201
Assistant Conductor wages (overtime)	12	\$18.13	\$326
Overhead			16.43%
Crew cost per game			\$893
Fuel costs	88	\$2.50	\$220
Incremental maintenance	88	\$2.50	\$220
Total vehicle mile charges			\$440
Total game day charges			\$1,337
Total weeknight trains and cost per season	46		\$61,327
Round trip riders per game needed to meet costs	240		

Stadium fans using this service are assumed to have taken a regularly scheduled train from the suburbs to Boston. The weeknight train's break-even ridership is 6.6% of the available market.

Unresolved details and other considerations

- Agreement with CSX for layover at Allston
- Close coordination of the dispatching of post-game trains with the CSX dispatcher and with the schedules of Framingham trains 585 and 537.
- Providing stadium fans with pre-game weeknight transportation from regularly scheduled inbound trains at South Station or at Back Bay.³³
- Restoration schedule for the “we” track at the Fort Point Channel (now temporarily out of service due to Central Artery/Tunnel construction)

Recommendation - KKO recommends holding this strategy until the proposed Kingston dedicated run turns out to be a successful demonstration of a worthwhile game day service concept.

4.5.C. Pre-game commuter rail from South Station to Yawkey

This strategy would provide a missing link for stadium fans wishing to travel to the ballgame from South Station, Back Bay Station or any of the south side commuter rail stations. The riders would be able to leave their inbound train at Back Bay or South Station, transfer to the Worcester/Framingham train, and complete their journey to the ballpark. Return trips would be via a variety of transit modes including the existing Framingham trains, the Red Sox’ Ruggles shuttle connecting with regularly scheduled late night Stoughton, Franklin, and Providence trains³⁴, or the post-game train direct from Yawkey to Providence discussed in operational strategy D.

This strategy consists of including a stop on most regularly scheduled outbound Framingham/Worcester line commuter rail trains at Yawkey station between 4:30 PM and 7:15 PM³⁵ on weekdays when a 7:05 PM ballgame is scheduled. These added stops would not conflict with existing inbound game day service from Framingham to Yawkey.

Passengers holding a valid commuter rail monthly pass, twelve-ride ticket, or the return portion of a pre-purchased round-trip ticket would be allowed to ride from South Station or Back Bay to Yawkey station. Conductors would spot-check tickets to the extent practical to discourage use of this service by persons who are not commuter rail riders.

³³ See operational strategy C (Pre-game commuter rail from South Station to Yawkey) for a possible partial resolution of this issue. See operational strategy G (Coordinated commuter rail at Ruggles) to understand why connections via Ruggles are probably not viable.

³⁴ As is discussed under operational strategy G, eastbound and northbound afternoon trains on these lines cannot stop at Ruggles station to provide a pre-game connection with the Red Sox’ shuttle.

³⁵ This would include trains 519, 571, 523, 575, 529 and 597 to Worcester or Framingham. Train 577 to Worcester at 6:05 p.m. could not stop at Yawkey due to a conflict with Train 524 from Framingham that already serves Yawkey.

Due to the short length of the current Yawkey platform, train crews and station officials would need to “herd” all stadium fans into two cars of the train to facilitate unloading. This would pose a minor challenge for train crews and terminal information agents. This situation could be mitigated by extending the current low platform to the east³⁶ as suggested in Section 4.5.A.

Total market served -The service would provide new travel options for the 9,000 stadium fans who drive to the ballgame via the south corridor, plus a portion of the 8,000 stadium fans who travel by car via the Mass Pike from communities served by the Franklin line.

Market potential - There are no data readily available to reliably estimate the number of riders that this service would divert to transit.

Costs and revenues

- The MBTA would incur the minor costs of making station stops at Yawkey in an area where the train is normally traveling at 30 mph.
- The MBTA would realize no direct revenue from this service. The MBTA could, however experience an increase in commuter rail travel on other trains by stadium fans whose round trip is enabled by this “missing link”.

Unresolved details and other considerations

- Determining whether these heavily patronized trains have the capacity to also handle stadium fans, even as standees, for this short ride.
- Managing stadium fans disembarking at the current short two car platform at Yawkey. *The MBTA may wish to postpone implementation of this strategy until a longer platform is constructed at Yawkey.*
- Managing stadium fans to concentrate themselves in the first two cars of the consist to facilitate unloading at Yawkey’s short platform.
- Mitigating any adverse reactions by through commuter passengers to carrying ball game fans for the first seven minutes of their commute home.

Recommendation - KKO recommends the MBTA consider station stops at Yawkey for pre-game outbound trains on the Framingham/Worcester route. This strategy may help achieve increased commuter rail ridership from the existing Ruggles shuttle bus service and it may also be very useful in realizing the full potential ridership of Operational strategy B (direct post-game commuter rail service from Yawkey to Providence/Attleboro).

³⁶ There is room to extend the platform toward Beacon street to achieve total platform length of approximately 440 feet. This is enough to accommodate five full cars and one end of a sixth car. The trains involved are seven cars long.

Due to passenger management issues with long trains and a short platform at Yawkey, the MBTA may wish to postpone implementation of this strategy until a longer platform is constructed at Yawkey.

Unless, and until, a turnback station and storage facility are built on the inactive portion of the Highland Branch, KKO recommends that this option be limited to stopping existing trains at Yawkey and that a dedicated shuttle train between South Station and Yawkey not be attempted.

4.5.D. Longer Green Line trains dedicated to post-game service

In this strategy, the MBTA would use three-car (rather than two-car) Green Line trains to run its existing post-game run-as-directed service. This would increase capacity without decreasing headways between trains. One possible scheme is described below.

- The three cars currently stored on the Kenmore loop³⁷ would operate as a 3-car run-as-directed train to Riverside³⁸.
- The six cars stored at Blandford³⁹ would be increased to eight cars (two 3-car trains and one 2-car train) to run-as-directed to downtown.
- The four cars stored in upper yard would be increased to six to operate as two 3-car trains to run-as-directed either outbound or inbound from Kenmore.

Table 4-14 Longer Green Line Trains					
Storage location	Current number of cars	Potential number of cars	Increased cars	Current number of trains	Potential number of trains
Kenmore Loop	3	3	0	1	1
Blandford	6	8	2	3	3
Upper Yard	4	6	2	2	2
Totals	13	17	4	6	6

This scheme could be expanded to handle even greater demand by storing additional three-car run-as-directed trains at Upper Yard or at Packard's Corner.

Total market served – This strategy would improve service for all 11,700 stadium fans using the Green Line plus those fans who avoid using the MBTA because of the post-game crowds at

³⁷ MBTA reports capacity of Kenmore loop to be three cars.

³⁸ Could be sent to Cleveland Circle.

³⁹ MBTA reports capacity of Blandford to be eight cars.

Kenmore. It would also serve new riders attracted to the use the Green Line via transit demand stimulation strategies such as the bundled ticketing recommendation.

Market potential - This is a supply-based strategy, but it may have a secondary effect of increasing transit demand among those who avoid the crowded subway. In the example shown above capacity increases by 600 peak riders.

Costs and revenues - The approximate cost of operating four additional run-as-directed cars is \$597 per game day. Approximately 300 additional riders would be needed to offset the cost. This ridership is equivalent to a 2.5% increase in Green Line eastbound post-game ridership.

Table 4-15	
Longer Green Line Trains Cost Analysis	
Incremental number of operators	4
Hourly wage per operator (overtime)	\$35.40
Overhead	23.78%
Minimum hours of "hire"	3
Total wages and overhead	\$526
Average miles per car	21
Power per car mile	\$0.35
Maintenance per car mile	\$0.50
Total car mile costs	\$71
Total game day costs	\$597
Riders needed to offset costs	298

The break-even ridership is 2.5% of the current market.

The financial analysis is based on an overtime "hire" of senior employees. Additional 3-car post game trains would cost \$448 each.

Unresolved details and other considerations

- Confirmation of operability of three-car trains at all locations between Kenmore and North Station.
- Whether this strategy eventually can be extended to four-car trains

Recommendation - KKO recommends the MBTA consider experimental operation of three-car trains in place of two-car run-as-directed trains when post-game demand dictates.

4.5.E. Improved Post-Game service to North Station

Under this strategy, when Red Sox games run late, Green Line officials at Kenmore would dispatch one or more run-as-directed trains to North Station (with a minimum of intermediate station stops) rather than turning these trains at Park Street. The MBTA's Operations Control

Center duty supervisor would coordinate with Amtrak's northside commuter rail dispatchers to hold "last" trains until connections can be made from the run-as-directed Green Line trains.

The Red Sox and the MBTA would publicize this coordination and the time limits involved so that fans know in advance that their connection at North Station will be protected during late games. In instances of extremely late games⁴⁰, the Red Sox would make public address announcements at the game to warn fans when they must leave to avoid missing the connection to the last train.

Total market served – This change could make commuter rail a more viable option for the nearly 11,000 stadium fans traveling to the game by automobile via the north and northwest corridors.

Market potential - There are no data upon which to estimate how many of the 11,000 fans from the northern corridors would change their mode choice from automobile to commuter rail based on knowing that their last train connection was protected.

Costs and revenues - Train delays at North Station could cost up to \$350 per game on the few⁴¹ occasions when night games ran later than 11:00 PM. If 1999 is typical, four games per season run beyond 11:00 PM and the cost of this strategy would be less than \$1,400 per year. Incremental income from this strategy would offset costs if an average of only 2.1 of the 11,000 fans (0.02%) in the available market shifted from automobile to Northside commuter rail.

Table 4-16	
North Station Coordination Cost Analysis	
Number of trains	4
Maximum delay per train (hours)	1/2
Crew costs per overtime hour per train	\$173
Total overtime cost	\$346

If four games per season run beyond 11:00 PM, this strategy costs less than \$1,400 per year.

Unresolved details and other considerations

- None

Recommendation - KKO recommends implementation and widespread publication of this strategy when the North Station transit "superstation" opens.

⁴⁰ No such games took place in 1999.

⁴¹ Four games in 1999.

4.5.F. Express trains from Riverside to Kenmore

Description of the strategy - the MBTA would run and promote demand-based run-as-directed Green Line trains between Riverside and Fenway/Kenmore on game days. These special trains will stop at few, if any intermediate stations.

These express trains would save only a few minutes from the normal Green Line schedule. However, the perceived concept of a special dedicated express train may attract an undefined fraction of the automobile market.

This strategy could be introduced in conjunction with previously described Institutional Strategies A (bundled ticketing), E (pre-game events at Riverside), and F (signage near Riverside).

Total market served - Improvements to Riverside/Fenway service would benefit the 8,300 stadium fans traveling from the west by automobile plus the 1,600 stadium fans already using the Riverside line.

Market potential - There are no data available upon which to quantify the market potential of this strategy.

Costs and revenues - Operation of a three-car train round trip (assuming a long 3:30 hour game) is \$714 per game. Incremental revenues will offset costs if the strategy diverts 2.4% of the automobile market in the west corridor to transit.

Table 4-17	
Riverside Express Trains Cost Analysis	
Incremental number of operators	3
Hourly wage per operator (overtime)	\$35.40
Overhead	23.78%
Duty hours	5
Total wages and overhead	\$657
Average miles per car	22
Power per car mile	\$0.35
Maintenance per car mile	\$0.50
Total car mile costs	\$56
Total game day costs	\$713
Round trip fares needed to offset costs	203

The break-even ridership is 2.4% of the available market.

This cost analysis is based on a overtime "hire" of senior employees.

Unresolved details and other considerations – It is not clear when to schedule the additional capacity to best correspond with demand.

Recommendation - KKO recommends that when Riverside/Fenway demand grows to warrant run-as-directed trains, the MBTA consider express or limited stop operations to maximize customer appreciation and marketability.

4.5.G. Coordinated commuter rail at Ruggles

This strategy seeks to improve the number of commuter rail services that are effectively connected to Fenway Park via the Red Sox' Ruggles shuttle. Ruggles station serves some, but not all trains on the Needham, Franklin, Stoughton, and Attleboro/Providence lines. Suggested changes have included:

- Have more inbound commuter rail trains stop at Ruggles station prior to ballgames.
- Have more outbound commuter rail trains stop at Ruggles station after ballgames.
- Delay the departure of the last train of the night on each line when games run late.

Among these suggestions, only two actions appear to be possible:

- Have outbound Franklin train #731 stop at Ruggles at 11:58 PM,
- Hold outbound Franklin train #731 up to 20 minutes and outbound Attleboro train #827 up to 10 minutes when games run exceptionally late.

Technical issues, discussed below, preclude other suggested changes in commuter rail service at Ruggles.

Total market served – Commuter rail service at Ruggles station can be potentially used by the 3,600 stadium fans who travel via automobile via Route 95 (south). It could also be useful to an undetermined proportion of the 8,000 stadium fans who travel by automobile via the west corridor but could use Franklin or Needham line service.

Market potential - There are no data available on the number of stadium fans who are potential Franklin line riders. Nor are data readily available to estimate the proportion of these fans who would be diverted from automobile to rail by having train #731 stop at Ruggles. Similarly, there are no data readily available to help predict how holding the late night Attleboro train for long Red Sox home games would improve the attractiveness of that route for stadium fans.

Costs and revenues

- The MBTA would incur some minor costs stopping Franklin train #731 at Ruggles.
- The MBTA would also incur minor labor costs on the rare occasions when Franklin train #731 and Attleboro train #827 are held for stadium fans.
- In 1999, these labor costs would have been less than \$300 for the entire season.

Table 4-18	
Franklin Train #731 Coordination Cost Analysis	
Number of trains	4
Delay per train (minutes)	20
Crew wages per overtime hour per train w/overhead	\$173
Total overtime cost	\$231

In 1999, delaying the last Franklin train for late games would have cost less than \$250 for the entire season.

Table 4-19	
Attleboro Train #827 Coordination Cost Analysis	
Number of trains	2
Delay per train (minutes)	10
Crew wages per overtime hour per train w/overhead	\$173
Total overtime cost	\$58

In 1999, delaying the last Attleboro train for late games would have cost about \$50 for the entire season.

Unresolved details and other considerations

- Does stopping train #731 at Ruggles create operational conflicts
- Are dispatching issues caused with delaying trains #731 and #827

Technical issues

- The MBTA cannot readily increase the number of inbound weekday commuter rail trains stopping at Ruggles station during the afternoon or early evening.⁴² There is no Ruggles station platform adjacent to the primary track for inbound trains (track 2)⁴³. Afternoon and early evening inbound trains cannot readily be rerouted to one of the two tracks which do have station platforms (tracks 1 and 3) because of the high density of opposing outbound trains.⁴⁴

⁴² Inbound trains currently do not stop at Ruggles station on weekdays between 2:41 PM and 7:49 PM.

⁴³ There is no space available to construct such a platform.

⁴⁴ The situation cannot be resolved by reversing the operating pattern of the railroad and designating either track 1 or track 3 as the primary inbound track. Doing so would increase conflicting train moves at Forest Hills and at Readville. It would also prevent some outbound trains from making station stops to pick up commuters.

- Other than Franklin train #731, the MBTA already schedules the final outbound trains of the evening to stop at Ruggles.
- It does not appear practical to delay the final Stoughton train (#929 at 11:08 PM) for late ending baseball games because even a delay of 20 minutes would not have protected the stadium fans' connection for nine weeknight games in 1999.
- It does not appear practical to delay the final Needham train (# 635 at 10:38 PM) because that train runs so early in the evening and because the communities served by the Needham line have faster and more direct MBTA transit alternatives to Fenway Park.

Recommendation - KKO recommends that the MBTA determine if there are operating constraints that preclude stopping Franklin train #731 at Ruggles or with holding trains #731 and #827 when games run exceptionally late. If no major problems are found, KKO recommends that these two changes be implemented and heavily publicized in the 2001 season (providing the Red Sox continue to operate the Ruggles Shuttle bus).

Given the constraints of the schedule and the physical plant, KKO does not see how it can recommend the MBTA stop inbound afternoon or early evening trains inbound at Ruggles.

KKO does not recommend changes to the schedules or operation of the last trains of the evening on the Needham and Stoughton lines.

4.5.H. Express bus service from Fenway Park to Cambridge Red Line stations

KKO considered the implementation of a shuttle bus type service from the ballpark to Red Line stations in Cambridge. Both Kendall and Central Square Stations were considered. In concept, express #47 and CT-2 buses could be run as directed to transport passengers to/from the Red Line in Cambridge, thereby diverting passengers from a Red Line/Green Line connection at Park Street.

This strategy would also require implementing an institutional change under which the MBTA would allow free transfer between the Red Line at Kendall and Central and buses 47 and CT-2.

Total market served - The principal market for this service improvement would be the 2,700 stadium fans traveling by automobile from the northwest on the Route 2 and 2A corridors.

Market potential - A diversion is likely only if a bus/Red Line connection can be made a more attractive route than the current Green Line/Red Line connection at Park Street. On paper, the bus connection might be four to six minutes faster than the Park Street connection. However, KKO does not believe that fans would see this slight time saving as offsetting the less frequent headways of the bus. It seems unlikely that this strategy would divert substantial ridership.

Costs and revenues – Incremental operating costs of two buses (equivalent in capacity to one Green Line car) are nearly twice those of the Green Line car. In addition, this strategy would also entail \$423 per game in fare collection costs. Accordingly, assuming that Green Line capacity can be found to handle the ridership, it is clearly not cost-effective to implement the bus-to-Red-Line scenario using run-as-directed buses.

Table 4-20		
Bus to Red Line Connection at Kendall or Central		
vs.		
Park Street Connection (Green Line to Red Line)		
Cost Comparison		
	2 buses	1 Green Line car
Number of vehicles & operators	2	1
Hourly wage per operator (overtime)	\$36.06	\$35.40
Overhead	23.78%	23.78%
Duty hours	3	3
Total wages and overhead	\$260	\$131
Average miles per vehicle	10	12
Power or fuel per vehicle mile	\$0.35	\$0.35
Maintenance per vehicle mile	\$0.50	\$0.50
Total vehicle mile charges	\$17	\$10
Total game day charges	\$277	\$141

The same number of riders can be transported on the Green Line for half the hourly cost of the bus alternative

Table 4-21	
Free Transfer to Red Line	
Collectors at Kendall and Central	
Persons needed	2
Hours per person per game	5
Hourly rate (overtime)	\$34.14
Overhead	23.78%
Cost per game	\$423

Unresolved details and other considerations

- Method of controlling the actual free transfer

Recommendation - KKO does not recommend this strategy unless it becomes impossible to handle game-related ridership on the Green Line.

4.6. Capital Strategies to Improve Transit Service to Fenway Park

Depending on the results of the institutional and operational strategies discussed above, the MBTA may need to make decisions regarding substantial capital projects to better handle game-related ridership. Some such capital projects are general infrastructure improvements that go beyond merely improving game day service. As such, they go beyond the scope of this technical memorandum and should only be considered in the broader context of everyday MBTA service. Some projects of this nature are noted in Appendix A.

Four other potential capital projects, however, are more directly related to handling Red Sox game day ridership and are discussed here.

- A. Commuter rail turnback station and train storage facility
- B. Commuter rail service to the new turnback station
- C. Increased Green Line capacity at Fenway station
- D. Increased weeknight pre-game capacity on the Green Line

This technical memorandum does not provide detailed engineering and cost information on these large projects. Rather, this memo simply serves to:

1. Define the projects as items that should receive more detailed planning analysis as the expanded Fenway Park moves toward reality,
2. Describe the projects in sufficient detail that consideration of them can begin,
3. Provide order of magnitude cost estimates, and
4. Identify actions that the MBTA must take now to insure that the options to implement these projects remain open and are not foreclosed by new construction in the vicinity.

In particular, KKO strongly recommends that the MBTA quickly take steps to define and protect its possible assets needed for a new commuter rail turnback station and possible train storage facilities. To this end, the MBTA can use the EOTC Secretary's substantial leverage (under MGL §40-54A) to protect land formerly used by a railroad. With the EOTC, the MBTA currently has the opportunity to influence nearby development so that it protects transportation options while still maximizing the utility of the land to the developer. As time goes on, that opportunity may be reduced.

4.6.A. Commuter rail turnback station and train storage facility

Strategies to provide substantial new commuter rail service to Fenway Park require a rail station that is not on the Framingham/Worcester main line tracks. A suitable location for such a station is the inactive rail right-of-way and adjacent former railroad yards between Yawkey and Fenway stations.

Options for constructing such a facility are described in great detail in a separate report.⁴⁵ Generally a new switch would be installed on mainline track two. This switch facing eastward toward South Station and Back Bay would lead to one or more station and storage tracks that would occupy the inactive rail right-of-way leading toward Fenway Station and the Landmark Building. The principal station tracks would have high platforms for rapid boarding of large crowds, and would be long enough to handle complete trains.

Game-related trains except those from Framingham and Worcester could use the new station and would not stop on the main line. Only Framingham/Worcester line trains would continue to use a station platform on the main line.

The new turnback station presents three potential additional advantages for the MBTA:

1. It preserves the option for eventual implementation of a commuter rail shuttle between South Station and the Kenmore area,
2. It provides an opportunity for mid-day storage of four or more trainsets, and
3. It provides a link for snowplows and work trains to the Riverside line from the standard rail system.

Total market served – The turnback facility could be potentially used by the 8,900 stadium fans who typically drive from the south and by some of the 8,000 stadium fans who drive the game via the Route 9 and Mass Pike.

Market potential – Experimental service from Kingston will provide the MBTA with accurate data upon which to estimate ridership.

Costs and revenues – Stone and Webster estimates the costs for a new turnback station range between \$9.6 million and \$10.4 million including both construction costs and acquisition of land⁴⁶. With joint development of the turnback facility coordinated with parking garages and other buildings, the costs for land acquisition could be substantially reduced.

Unresolved details and other considerations

1. Nature and extent of commuter rail services that would be offered at turnback station
2. MGL §40-54A and its applicability to developing the turnback station and storage facility⁴⁷

⁴⁵ Stone and Webster Civil and Transportation Services, Inc, "Commuter Rail Turnback Study" Prepared for the Massachusetts Bay Transportation Authority, Revised Draft Submittal July 26, 2000.

⁴⁶ Ibid.

⁴⁷ MGL §40-54A has been in effect for approximately 25 years. It is designed to protect unused rail rights of way from being lost due to construction. Under MGL §40-54A, if land was ever owned or used by a railroad along or adjacent to a current or former railroad right of way, the land is unbuildable unless the EOTC Secretary, after a

Recommendation - KKO recommends that the MBTA act promptly to preserve its commuter rail and Green Line options along the inactive railway near the ballpark.

With respect to the turnback facility, KKO recommends that the MBTA act to:

1. Better define the nature and extent of services that would be potentially operated at this site. Train lengths and numbers of trains significantly impact the size of the required facility. The existing right-of-way could hold four or more full length commuter rail trains if fully developed for train storage.
2. Work closely with the developers of the new Fenway Park and related parking facilities to ensure harmony and synergy between the plans and operations of the MBTA and the baseball team.
3. Study the mainline capacity and terminal capacity at South Station required for new services to be operated using this facility.

public hearing, grants written permission for issuance of a building permit. Furthermore, if the current landowner acquired the land after January 1, 1976, the landowner has no financial recourse against the EOTC Secretary for such denial. Municipalities purchasing former rail land are specifically included in MGL §40-54A as being subject to its provisions.

Since adoption of the statute, the EOTC has used the substantial leverage under MGL §40-54A to achieve "win-win" solutions with potential developers of former rail property by fostering designs that will protect both the State's transportation needs and the desires of others for air rights and adjacent development. Examples include free transportation easements granted to the MBTA through the former station property in downtown Plymouth; the Somerset branch which was deeded free to the Commonwealth in return for the granting of railroad crossings and overhead structures to a company owning land bisected by the right of way; and the affordable purchase price negotiated by the Town of Bourne for a large tract near the Buzzards Bay station after the EOTC Secretary denied issuance of a building permit. The MBTA, with the EOTC, currently has the opportunity to achieve similar mutually beneficial solutions in the Yawkey station area and to minimize the Authority's capital costs. As plans for area development progress, this opportunity will be reduced.

All of the Highland Branch extending from the main line west to beyond Fenway station was once used by the Boston and Albany railroad and successor railroads. Most of the land in the vicinity of the present Yawkey station, including the undeveloped parking lots proposed for parking garage development, was also once used as a B&ARR rail yard. Thus, all of the land needed for the new Yawkey station (including the two extra track options) is subject to the statute.

It is not known if the adjacent rail yard properties (the parking lots) were acquired by their present owners before or after the beginning of 1976. This distinction is important because it substantially impacts the value of the land to the current landowner and the State's leverage in negotiating a mutually beneficial agreement in return for allowing the issuance of building permits.

4. Conduct preliminary engineering studies of desired alternatives and the proposed mainline station. Determine "footprint" required to accommodate required transit services and to define the transportation easements that should be negotiated to protect all reasonable station options.
5. Obtain a title opinion for the CSX right-of-way and all of the other potential properties to be acquired.

Decisions regarding whether a station should be built and regarding the station's exact design can be made in future years. However, decisions to protect the CSX right-of-way for continued transportation use are very time-critical and should be made now.

4.6.B. Commuter rail service to the new turnback station

If the experimental commuter rail services to baseball games prove successful, the next logical steps would be to:

1. Make the experimental services permanent.
2. Build the new turnback facility and related trackwork.
3. Potentially expand the game day commuter rail train concept to selected other commuter rail routes.
4. Consider rail shuttle service between South Station and the turnback facility, possibly in the context of an everyday shuttle service.

Total market served – On a game day the commuter rail turnback facility could potentially be used by a large fraction of the 16,900 stadium fans who drive from the west or south.

Market potential - Experimental Kingston service will provide the MBTA with accurate real world experience to estimate ridership for dedicated game day trains to Fenway Park.

Costs and revenues

Possible capital costs for game day services include:

- Costs for additional trainsets if pre-game weeknight service is required
- Land acquisition, station development and railway costs currently estimated in the range of \$9.6 to \$10.4 million.

Revenues can be better estimated when the results of the Kingston experiment are tabulated.

Recommendation - KKO recommends no immediate action by the MBTA other than preserving its options to develop a commuter rail turnback station and storage along the inactive portion of the old Highland branch.

4.6.C. Increased Green Line capacity at Fenway station

This strategy involves expanding the Green Line capacity for run-as-directed trains by adding

storage, and perhaps station, tracks along the Highland Branch in the vicinity of Fenway station. A crossover allowing Green Line cars to move between the inbound and outbound tracks could also be required.

The location of the proposed new ballpark is closer to Fenway Station. It is likely that the fraction of stadium fans using this station, instead of Kenmore, for game day travel will be higher than at the current ballpark. Consequently, it might be wise to consider strategies to expand the capacity of this station for game day services.

Currently, Green Line storage near Fenway Park is limited to three cars on the Kenmore loop (which can only run westbound on the Riverside and Beacon Street lines) and eight cars at Blandford street (which can only run eastbound toward downtown). Additional storage of run-as-directed cars is limited to more distant sites at Upper Yard, on the Riverside line near Reservoir, and at Packard's Corner on the Commonwealth Avenue line, more than two miles west of the tunnel portal.

This strategy would provide additional storage and staging facilities on the Riverside line immediately west of the tunnel portal. Cars stored and staged at this site could:

- Run westbound to Riverside directly from Fenway station,
- Run eastbound to Kenmore and then loop westbound on the Riverside or Beacon Street lines, or
- Run eastbound to Park Street and beyond.

KKO's site inspections indicate that creating a facility that feeds westbound traffic toward Riverside would be fairly easy to achieve within the confines of the inactive rail right-of-way owned by CSX. Creating a yard that would feed trains eastbound toward Kenmore and Park Street would likely require the acquisition of undeveloped land west of the CSX parcel. It is likely that the owner of this parcel is the MDC.

Total market served – This strategy would serve the 11,700 stadium fans currently forecast to use the Green Line for travel to the new ballpark, plus other new riders attracted by improved MBTA services and various joint promotions with the Red Sox.

Market potential - This is a supply-based strategy, but it may have a secondary effect of increasing transit demand among those who avoid the Green Line due to overcrowded conditions.

Costs and revenues - A storage track capable of holding three 3-car trains would cost approximately \$820,000, exclusive of land and easement costs.

Table 4-22

Cost Analysis – Green Line storage at Fenway (eight or nine car storage capacity)				
Item	Unit	Quantity	Unit Cost	Total Cost
Interlocking and connection with main line				
Powered switch (installed)	each	4	\$30,000	\$120,000
Signal (installed)	each	9	\$30,000	\$270,000
Track	linear feet	900	\$250	\$225,000
Subtotal				\$615,000
Contingency			20%	\$123,000
Engineering design			8%	\$46,125
Field force account			2%	\$12,300
Project Administration			4%	\$21,525
Total (Land and easement costs excluded)				\$817,950

Unresolved details and other considerations

- Availability and ownership of required land
- Potential conflicts with storage tracks planned for the new Yawkey station.

Recommendation - As previously discussed in section 4.6.A, KKO strongly recommends that the MBTA act quickly to preserve its commuter rail and Green Line options near the ballpark.

KKO recommends that the MBTA determine the “footprint” of a storage track west of the tunnel portal, determine the ownership and status of the needed land, and initiate steps with the EOTC Secretary to preserve the transit options on the parcels.

4.6.D. Increased weeknight pre-game capacity on Green Line

This strategy seeks to increase the capacity of the Green Line to carry passengers from downtown to the ballpark when there is pre-game demand during the evening rush hour.

A convenient means to achieve this strategy would be to use three-car trains in place of two-car trains for regularly scheduled service. Because of the MBTA’s high utilization of its fleet during the evening peak, any substantial number of three-car trains can only be achieved by the purchase of additional cars or by postponing the anticipated retirement of LRV’s when the new Breda fleet is fully functional.

If current modal split is maintained, over 2,300 additional riders will travel the Green Line to the game due to increased stadium seating. Assuming the current arrival patterns of fans at the game, most additional cars placed in service could make two game-related trips. This translates into a need for at least eight new Green Line cars.

Total market served - This strategy would serve the 11,700 stadium fans currently forecast to use the Green Line for travel to the new ballpark, plus other new riders attracted by improved MBTA services and various joint promotions with the Red Sox.

Market potential - This is a supply-based strategy, but it may have a secondary effect of increasing transit demand among those who fear large crowds within the confines of a subway station.

Costs and revenues - Eight green line cars would cost in the vicinity of \$20 million. In addition, it would cost MBTA \$1,600 per game day to operate these additional cars.

Table 4-23

Additional Green Line Cars Cost Analysis	
Incremental number of operators	8
Hourly wage per operator (overtime)	\$35.40
Overhead	23.78%
Hours of "hire"	4
Total wages and overhead	\$1,402
Average miles per car	30
Power per car mile	\$0.35
Maintenance per car mile	\$0.50
Total car mile costs	\$204
Total game day costs	\$1,606

It will cost the MBTA \$1,600 in operating costs per game to meet the increased demand of a new stadium.

The high capital costs indicate that the purchase of additional Green Line cars cannot be considered merely in the context of service to Red Sox games. Rather, it must be considered in the broader context of the MBTA's everyday capacity needs.

Unresolved details and other considerations - none

Recommendation - KKO does not recommend that the MBTA take action on this strategy except in the broad context of adjusting its fleet size to meet fluctuations in everyday demand in conjunction with event related services.

Appendices

Appendix A: Strategies that failed the initial screen

This appendix lists strategies to improve game day service that were considered but did not survive the initial screen because either

- They were of a scope far beyond the improvement of game day transportation to Fenway Park, or
- They were, even without detailed analysis, non-viable or physically impractical.

Strategies that did not survive the initial screen include:

1. Commuter Rail service from north of Boston
2. Improved Riverside line infrastructure
3. Commuter rail shuttle service to the existing Yawkey station
4. Dedicated Framingham/Worcester commuter rail service
5. Additional Green Line subway infrastructure capacity
6. Kenmore station expansion
7. Acquiring additional commuter rail trains for Red Sox service
8. New bus routes for Red Sox service
9. Urban ring
10. Subsidized private charter bus

KKO's working papers on each of these strategies are available for review.

Appendix B: Standard Units and Assumptions

Table B-1 Standard Vehicle Capacities		
Item	Standard	Source
Capacity of bus		
Seats	40	MBTA: Alan Castaline
Nominal rush hour	56	MBTA: Alan Castaline
Practical maximum	75	MBTA: Alan Castaline
Capacity of Green Line car		
Seats	50	MBTA: Alan Castaline
Nominal rush hour	127	MBTA: Alan Castaline
Practical maximum	150	MBTA: Alan Castaline
Capacity of Commuter rail cars (no standees)		
Kawasaki	182	MBTA: Jim Brennan
MBB (cab)	99	MBTA: Jim Brennan
MBB (trailer)	104	MBTA: Jim Brennan
Pullman	131	MBTA: Jim Brennan

Table B-2 Standard Fares		
Item	Standard	Source
2001 bus fare (standard)	\$0.75	MBTA
2001 subway fare (standard)	\$1.00	MBTA
2001 inbound fare from Riverside (standard)	\$2.50	MBTA
2001 zone 4 commuter rail fare (full fare)	\$3.50	MBTA
2001 zone 5 commuter rail fare (full fare)	\$4.00	MBTA
2001 zone 6 commuter rail fare (full fare)	\$4.25	MBTA

Table B-3
MBTA Labor Rates

Item	Standard	Source
Green line operator	\$23.60	MBTA: Alan Castaline
Green line trailer car	\$23.60	MBTA: Alan Castaline
Bus operator	\$23.37	MBTA: Alan Castaline
Collector	\$22.76	MBTA: Alan Castaline
Direct overhead on straight time (incremental)	61.11%	MBTA: Alan Castaline
Direct overhead on overtime (incremental)	23.78%	MBTA: Alan Castaline Straight time rate times the ratio of the overtime and straight time rates for commuter rail.
Minimum hire (overtime) hours	3	MBTA: Alan Castaline

Table B-4
Commuter Rail Labor Rates

Item	Standard	Source
Engineer	\$26.65	MBTA: Les Stephenson
Conductor	\$22.33	MBTA: Les Stephenson
Assistant Conductor	\$18.13	MBTA: Les Stephenson
Overhead on straight time	42.22%	MBTA: Les Stephenson
Overhead on overtime	16.43%	MBTA: Jim Brennan
Minimum hire from spare board (hours)	4	MBTA: Les Stephenson
Effective minimum day for frequent events	8	MBTA: Jim Brennan
Travel time to/from suburban sites	1	MBTA: Les Stephenson
Overtime commuter rail crew per hour w/overhead (Engineer, conductor, and 2 assistant conductors)	\$173	MBTA: Jim Brennan
Hourly pay for commuter rail maintainer/cleaner	\$20.00	MBTA: Jim Brennan

Table B-5 Non-Labor Incremental Operating Costs		
Item	Standard	Source
Incremental fuel and maintenance costs		
Bus fuel	\$0.35	MCRS OGRV vehicle fuel performance report 3.6 mpg @ \$1.25/g
Bus maintenance	\$0.50	Assumption - no MBTA data available
Green Line car power	\$0.35	Assumed equal to bus fuel - no MBTA data available
Green line car maintenance	\$0.50	Assumption - no MBTA data available
Commuter rail locomotive fuel per mile	\$2.50	(based on \$1.95 per mile in early 1999)
Commuter rail train maintenance	\$2.78	Assumes mileage based MOE is 20% total MOE (total MOE and total miles from MBTA Nelson Chin)

Table B-6 Construction costs		
Item	Standard	Source
Commuter rail track (installed)		
Powered switch (with one signal)	\$250,000	MBTA: Ken Belovarac
Additional signals	\$50,000	MBTA: Ken Belovarac
Hand throw switch (no signal)	\$50,000	MBTA: Ken Belovarac
Yard track per foot	\$250	MBTA: Ken Belovarac
Green Line track installed		
Powered switch (without signal)	\$30,000	MBTA: Ken Belovarac
Signal	\$30,000	MBTA: Ken Belovarac
Yard track per foot	\$250	MBTA: Ken Belovarac
Commuter rail high platform (800 ft) (w/o awning)	\$800,000	MBTA standard (Old Colony platforms)
Comm. rail sta. grading, lights, signs, & finishings	\$300,000	MBTA standard (Old Colony stations)
Paved walkway (10 foot wide, per linear foot)	\$75	MBTA Planning (Allston/Brighton commuter rail feasibility study)
Paved low platform (per linear foot)	\$100	Extrapolated from Allston study
Fence per foot	\$50	MBTA Planning (Allston study)
Trackside power per trainset	\$200,000	MBTA Southampton study

Table B-7 Capital Project Overheads		
Item	Standard	Source
Contingency	20.0%	MBTA Planning (Allston study)
Engineering design	7.5%	MBTA Planning (Allston study)
Field force account	2.0%	MBTA Planning (Allston study)
Project Administration	3.5%	MBTA Planning (Allston study)

Table B-8 Other Assumptions		
Item	Assumption	Source
Diversion due to bundling (% of existing riders)	30%	Munich MVV experience
Distribution of current MBTA ridership to game:		
Subway (includes commuter rail to subway)	60%	Roughly based on CTPS counts
Green Line Surface (Commonwealth and Beacon)	15%	Roughly based on CTPS counts
Riverside	15%	Roughly based on CTPS counts
Bus	6%	Roughly based on CTPS counts
Rail to/from Yawkey	4%	Roughly based on CTPS counts
Percent stadium fans with MBTA monthly passes	10%	Assumption (many non-regular MBTA users at game)
Average fare collected on proposed Attleboro / Providence line game day dedicated service	79% of Zone 4 fare	Disproportionately high use of Route 128 station. Mix of full fare, reduced fare, and monthly passes.
Average fare collected on proposed Kingston line game day dedicated service	79% of Zone 5 fare	Disproportionately high use of Braintree station. Mix of full fare, reduced fare, and monthly passes.
Maximum round trip contribution from ticket bundling	\$2.00	